

Sensory Organs Skin

seminar from Human Morphology

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Sensory Organs

- ORGAN OF VISION
- ORGAN OF HEARING AND BALANCE
- ORGAN OF SMELL
- ORGAN OF TASTE
- SKIN RECEPTORS

Organ of Vision – Eye

1) FIBROUS TUNIC

- sclera – white of the eye, dense fibrous connective tissue
- cornea – convex anterior portion of the eye, avascular and clear

2) VASCULAR TUNIC

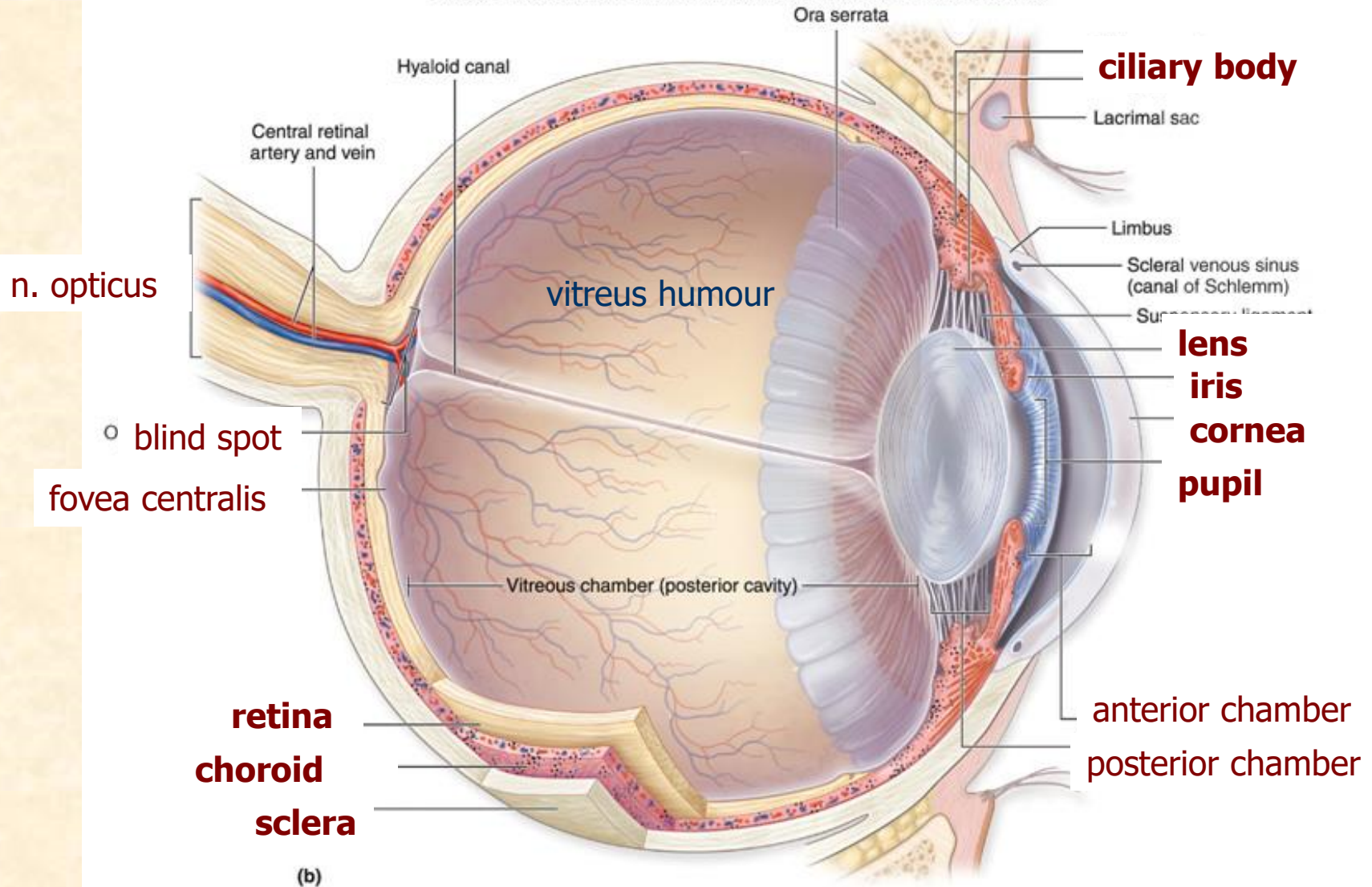
- choroid – loose fibrous tissue with vessels (nutrition)
- ciliary body contains ciliary muscles which can alter the shape of the lens
- iris – pigmented cells with intrinsic muscles that regulate the opening, the pupil
 - sphincter pupillae muscle (innervation by parasympathetic s.)
 - dilatator pupillae muscle (innervation by cervical sympathetic s.)

3) NEURAL TUNIC

- retina – composed of rods (do not discriminate colour, night vision) and cones (color vision)
 - fovea centralis: the most sensitive to light and responsible for sharp vision
 - „blind spot“, optic disc: it lacks photoreceptors

Eye

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Auxiliary Structures to the Eye

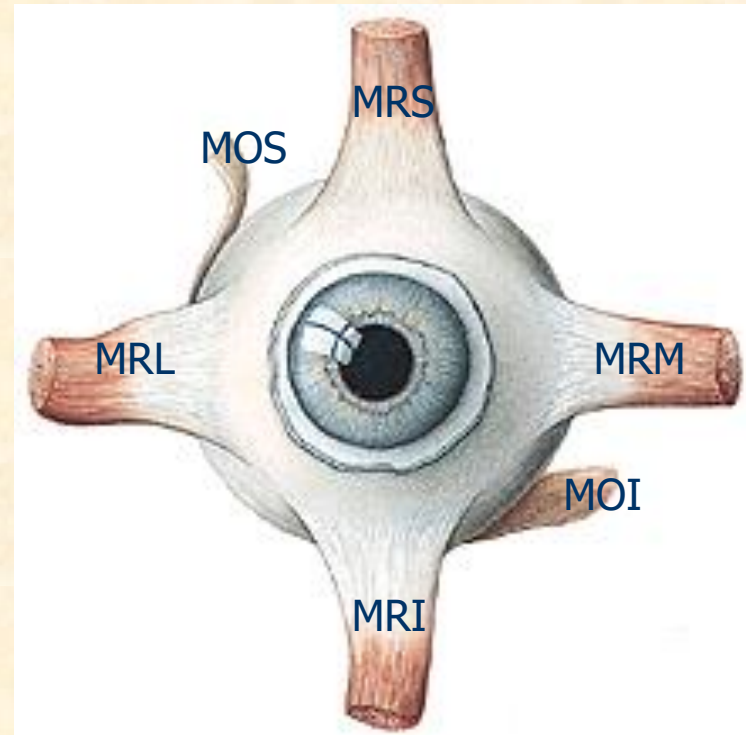
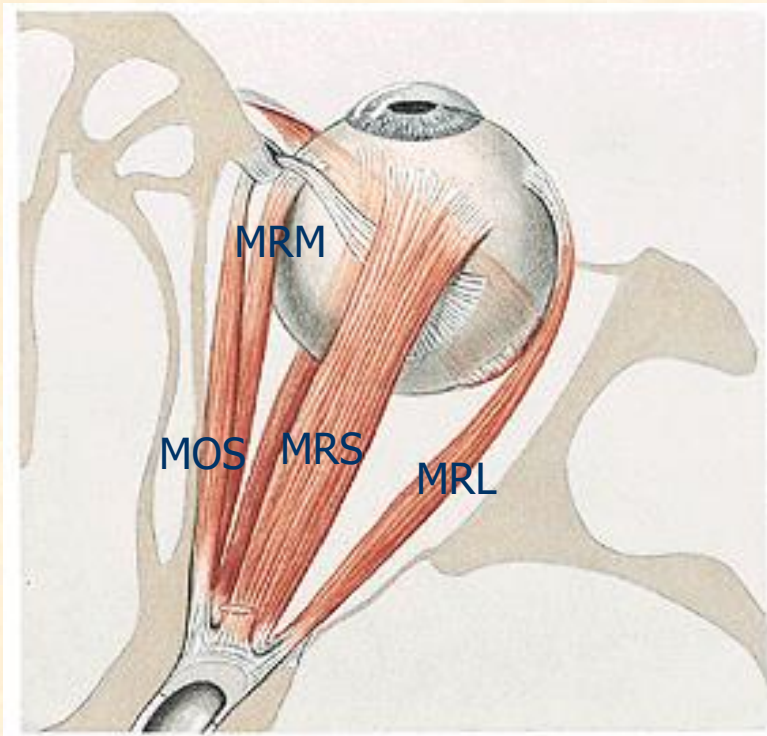
1) EXTRAOCULAR EYE MUSCLES

2) EYELIDS

3) CONJUNCTIVA

4) LACRIMAL APPARATUS

Muscles of the Eye



MRS = musculus rectus superior

MRI = musculus rectus inferior

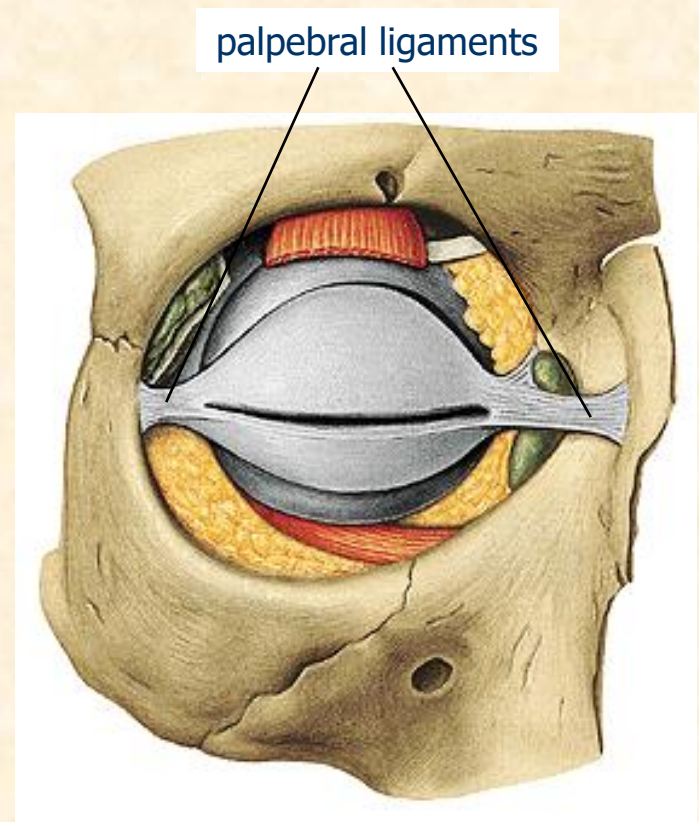
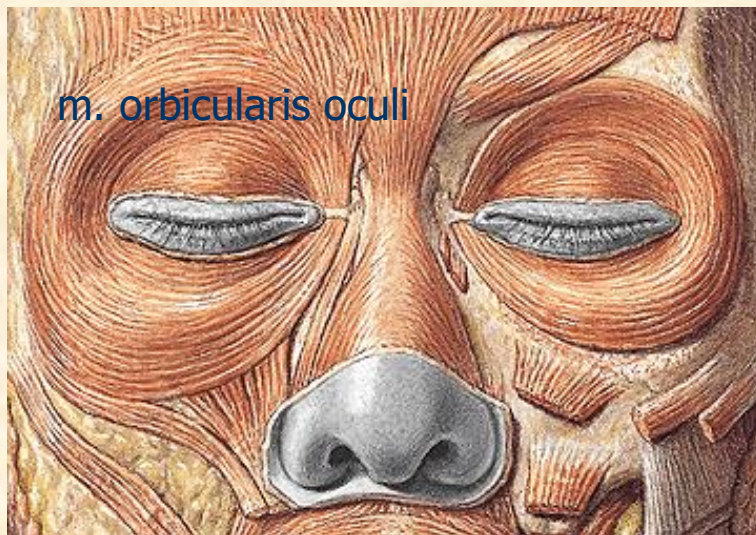
MRM = musculus rectus medialis

MRL = musculus rectus lateralis

MOS = musculus obliquus superior

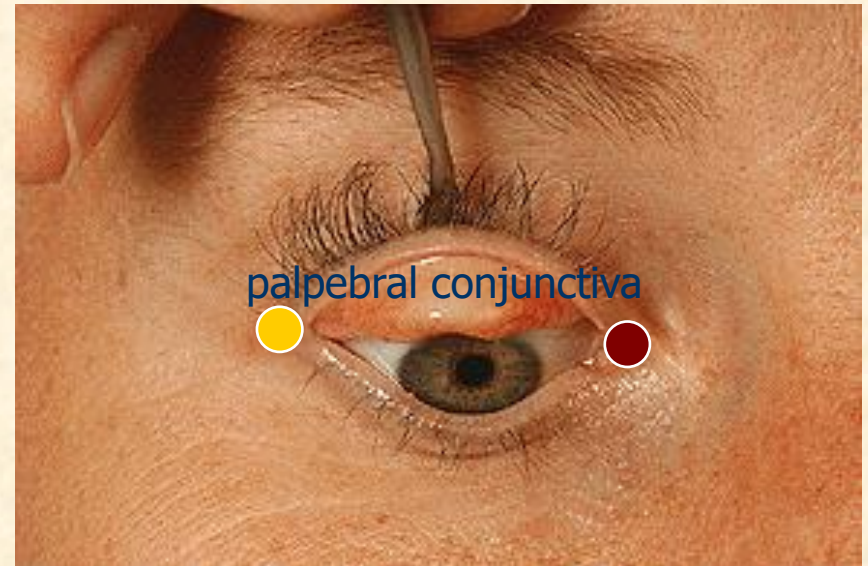
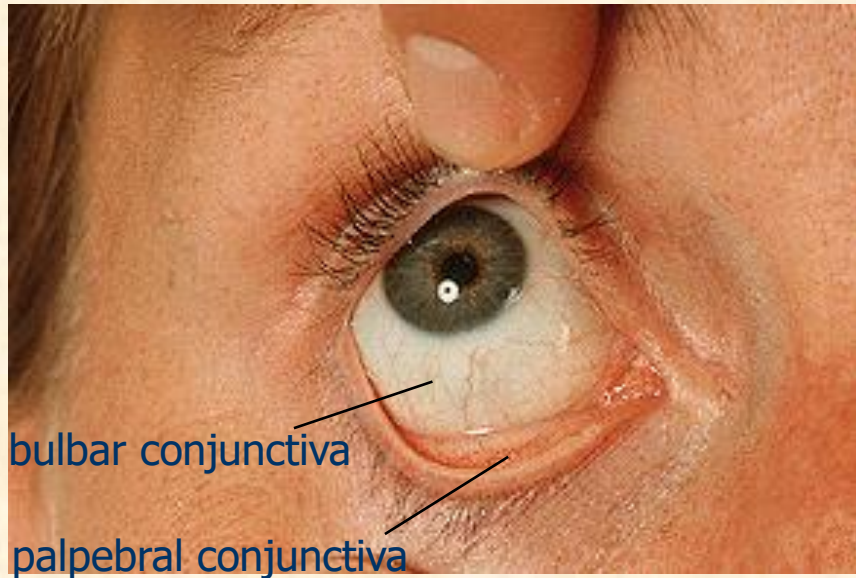
MOI = musculus obliquus inferior

Eyelids



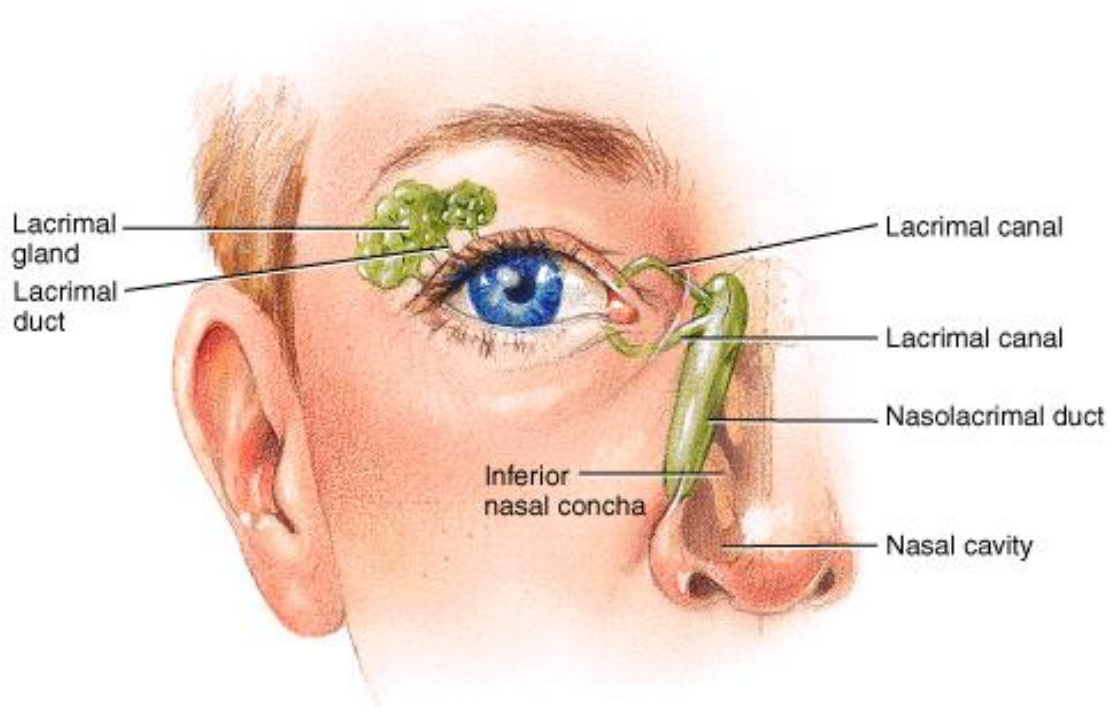
Conjunctiva

- clear mucous membrane that covers the sclera and lines the inside of the eyelids, helps lubricate the eye
- palpebral and bulbar conjunctiva



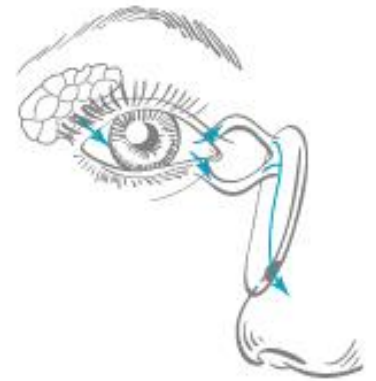
- lateral angle of eye
- medial angle of eye

Lacrimal Gland

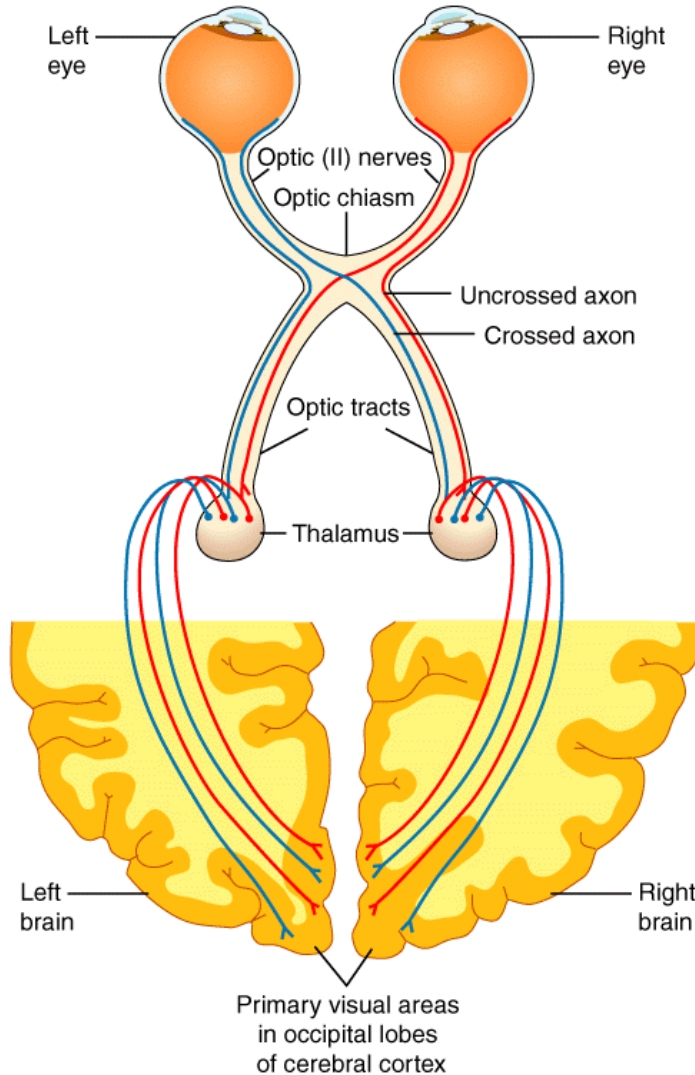


Anterior view of the lacrimal apparatus

FLOW OF TEARS



Optic Pathway



Organ of Hearing and Balance – Ear

1) **EXTERNAL (OUTER) EAR**

- auricle
- external auditory canal
 - cartilaginous – skin with hairs and sebaceous glands producing earwax (cerumen)
 - bony part – inner two thirds of canal
- tympanic membrane (eardrum)
 - thin translucent pearl-grey membrane forming the boundary between the outer and the middle ear

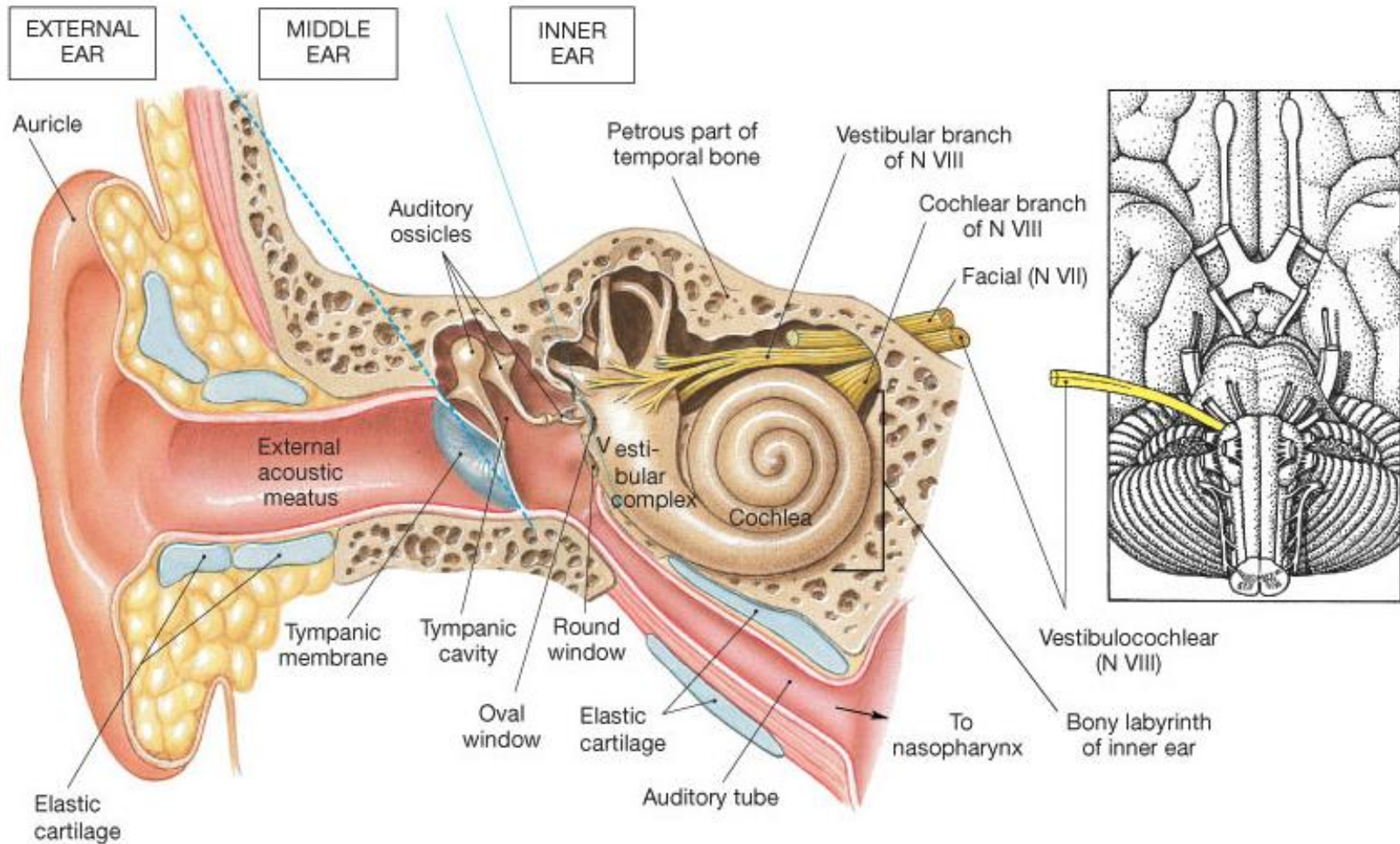
2) **MIDDLE EAR**

- tympanic cavity with auditory ossicles
 - hammer (malleus)
 - incus (anvil)
 - stapes (stirrup)

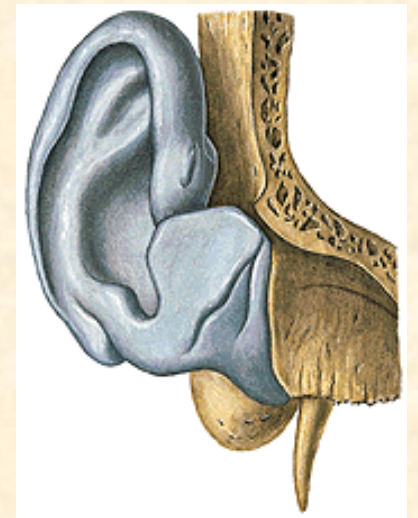
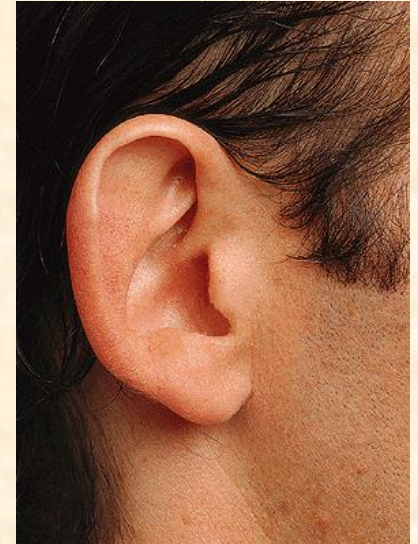
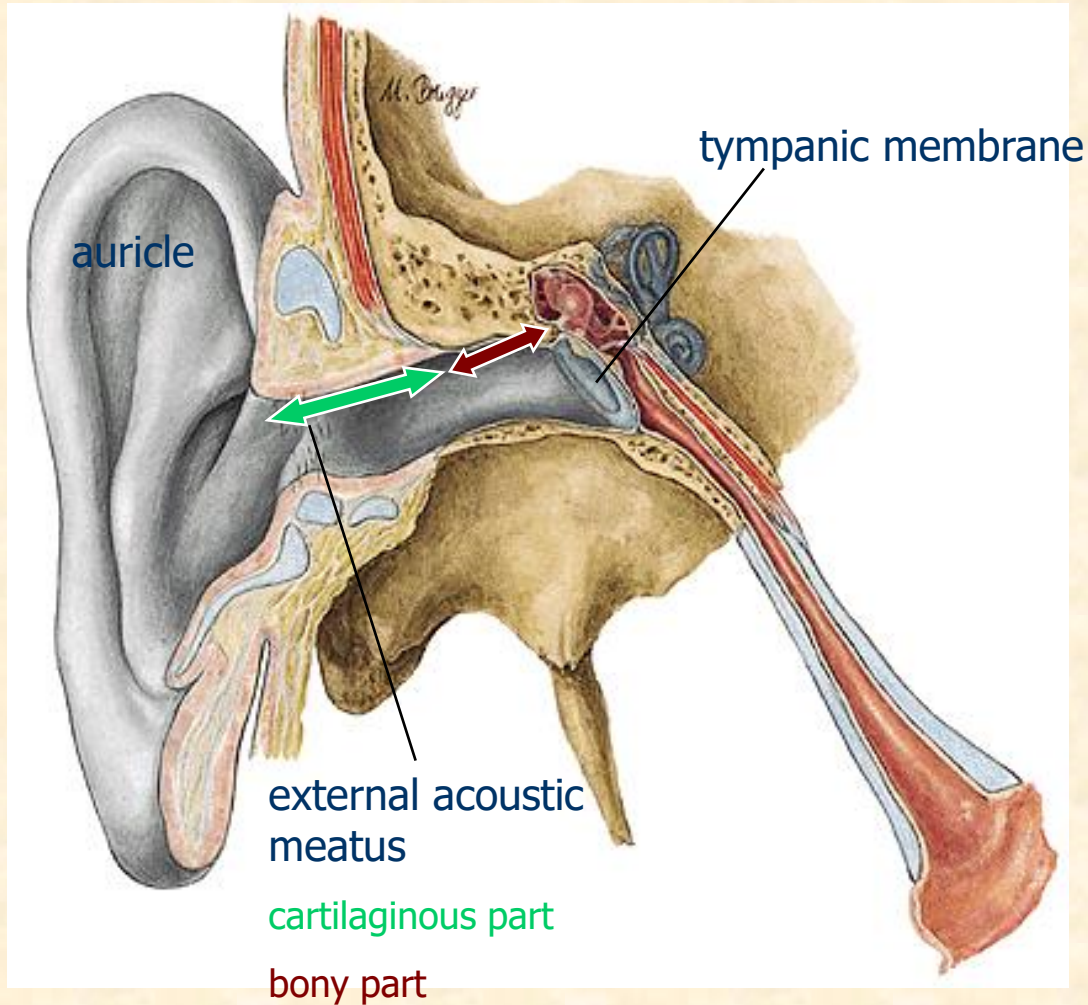
3) **INNER EAR**

- membranous labyrinth contained within the bony labyrinth
- vestibule
 - utriculus
 - sacculus
- semicircular canals (anterior, lateral and posterior) – allow a complex analysis of head movements in relation to the body position
- cochlea – hearing part of ear

Ear

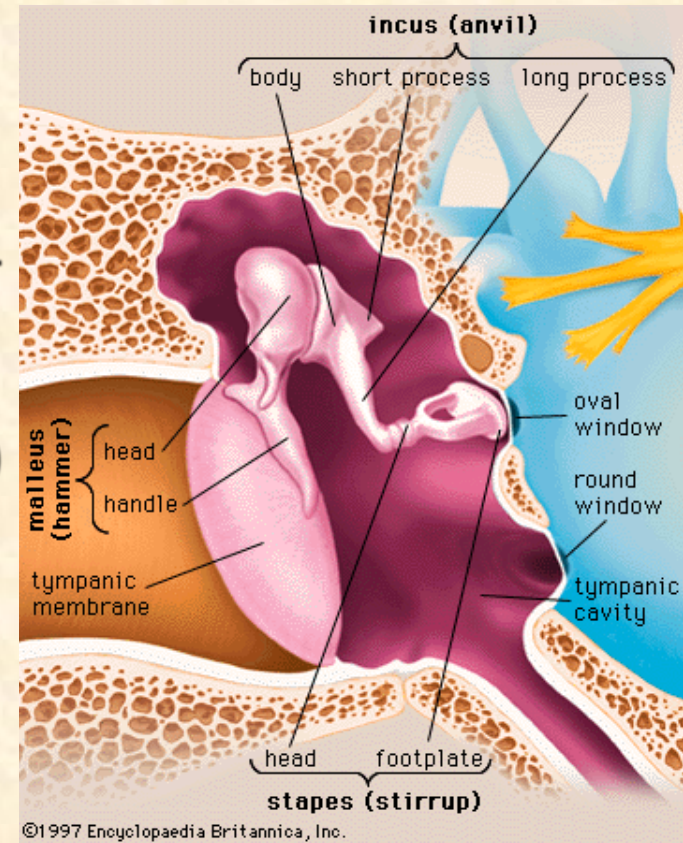


External Ear



Middle Ear

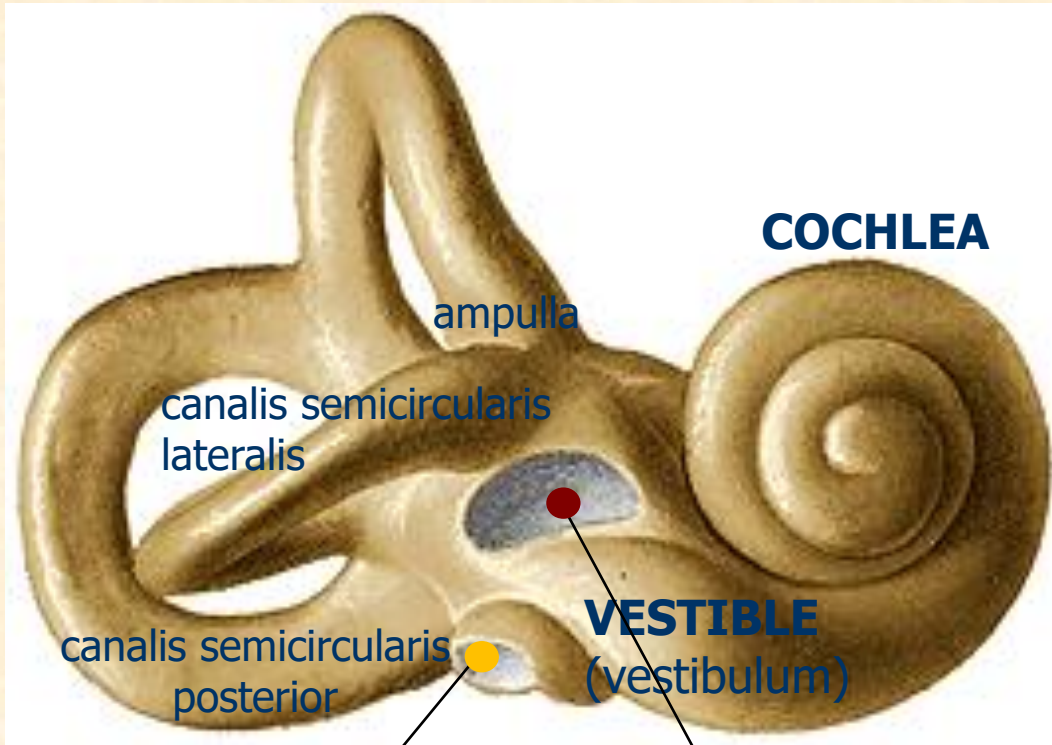
- tympanic cavity
 - malleus (hammer)
 - incus (anvil)
 - stapes (stirrup)
- oval window (fenestra vestibuli) + stapes footplate → transmission of the sound wave to the inner ear
- round window (fenestra cochleae)
 - compensation for changes in perilymph volume
- Eustachian tube (tuba auditiva) – connection of the middle ear to the nasopharynx → ventilation function



Inner Ear – Bony Labyrinth

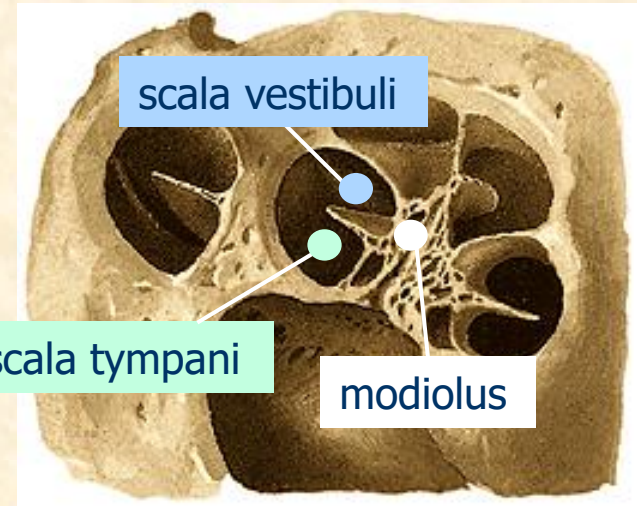
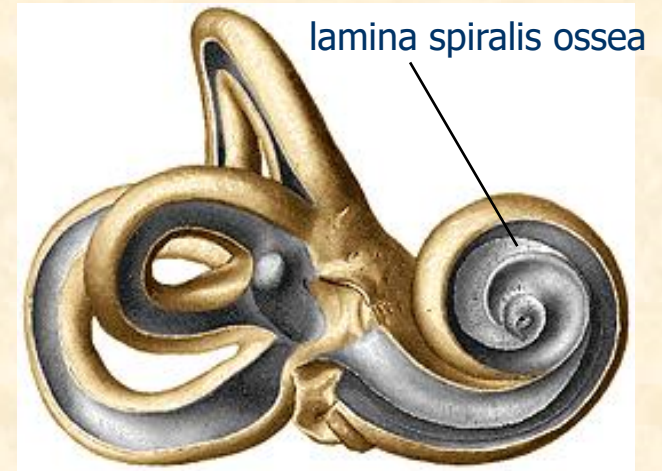
SEMICIRCULAR CANALS

canalis semicircularis anterior



oval window

round window



Inner Ear – Membranous Labyrinth

semicircular canals

ductus semicircularis anterior

cochlear duct

n. cochlearis

n. vestibularis

sacculle

utricle

AMP

AMP

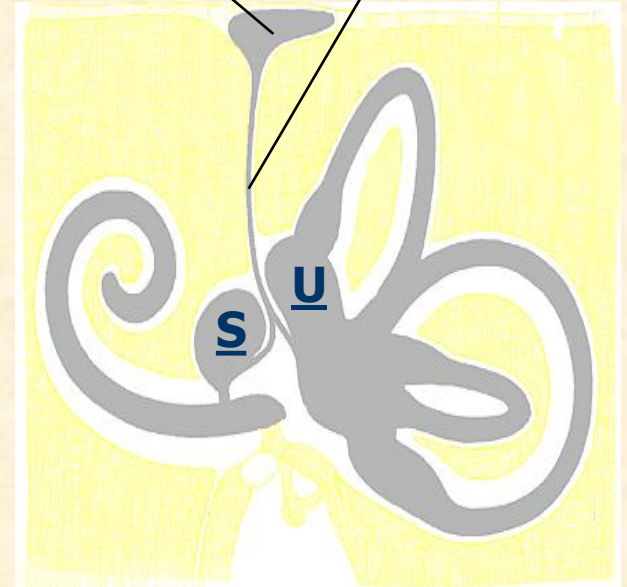
AMP

ductus
semicircularis
lateralis

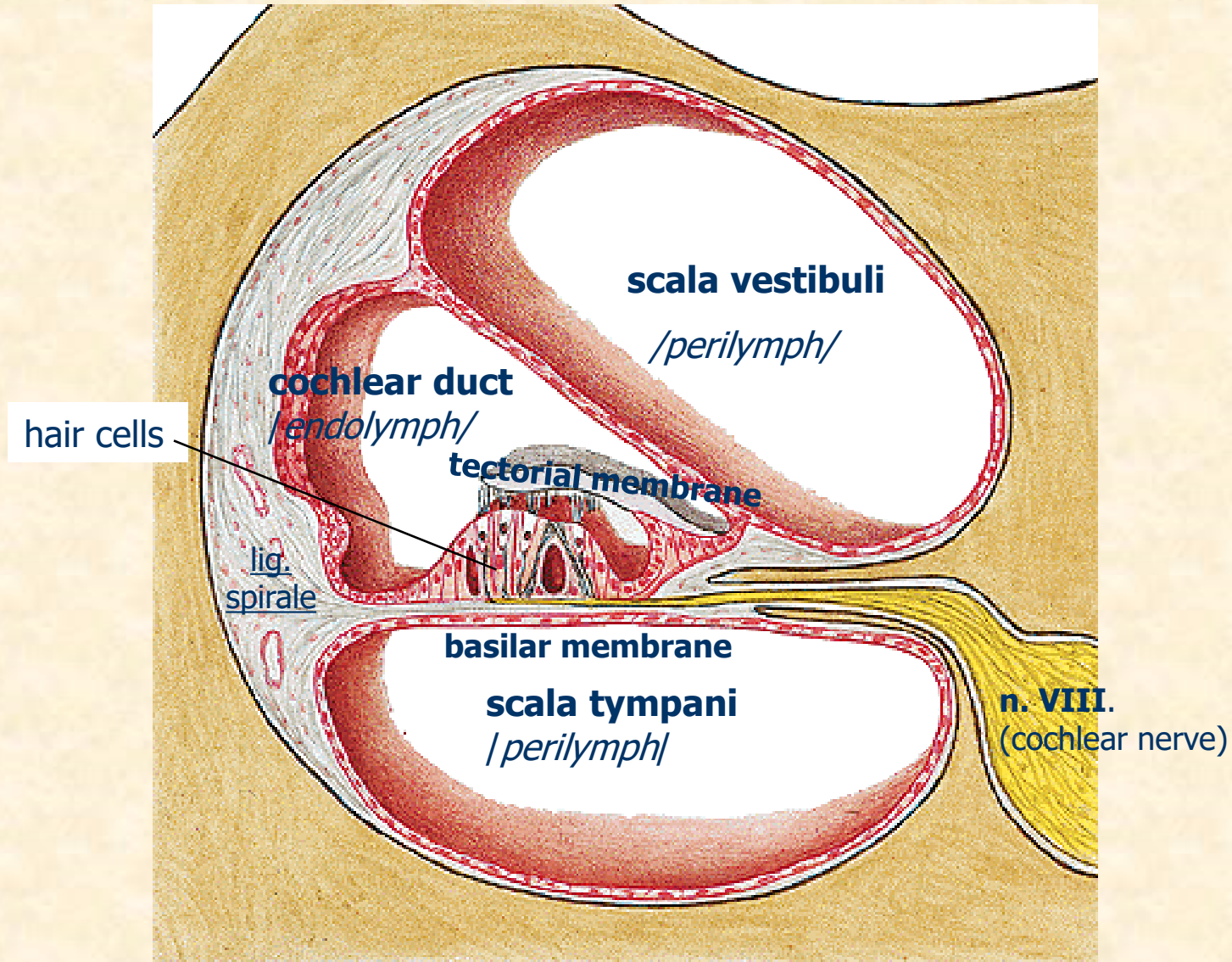
ductus semicircularis posterior

endolymphatic sac

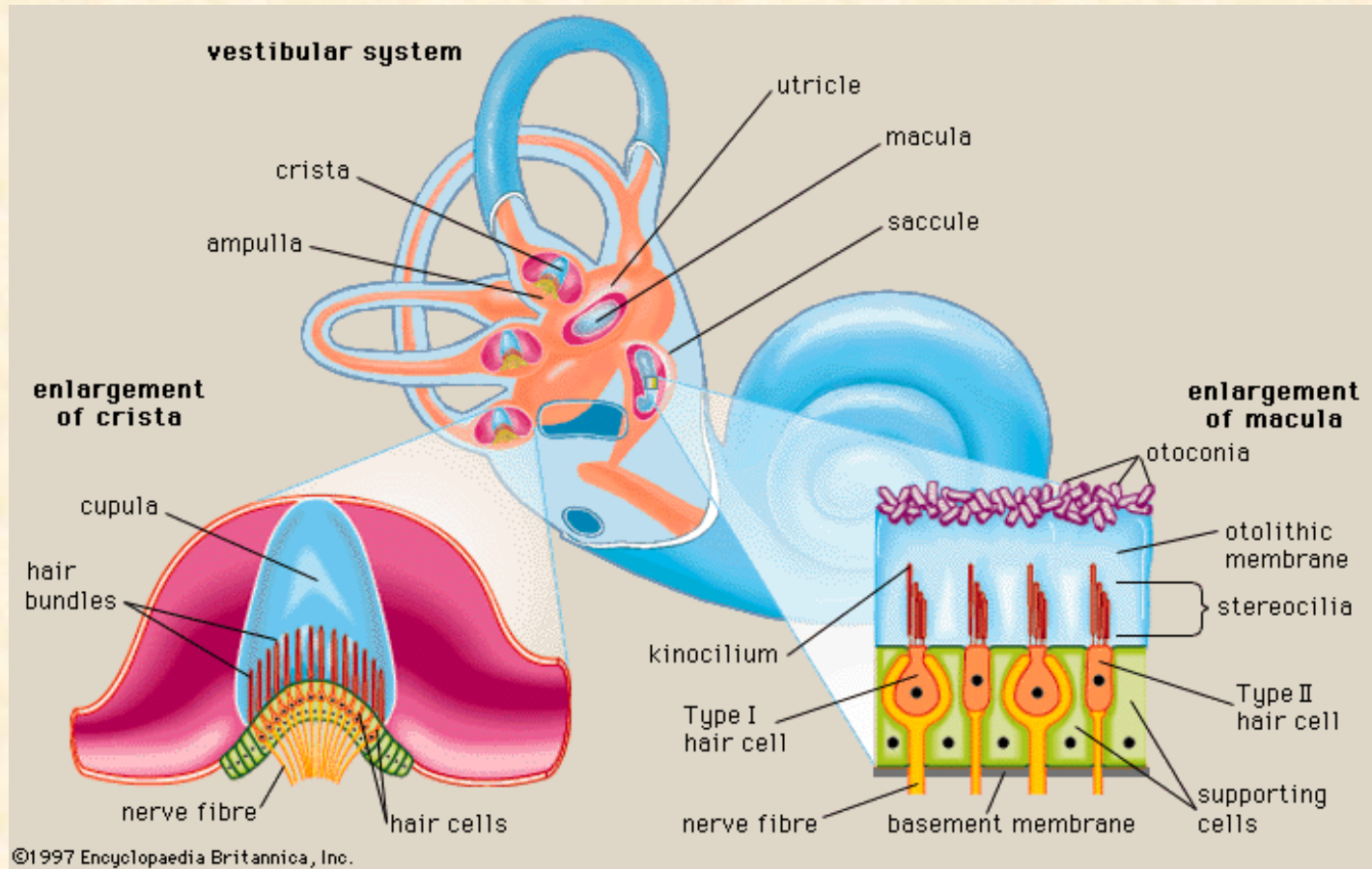
endolymphatic duct



Inner Ear – Organ of Corti



Organ of Balance

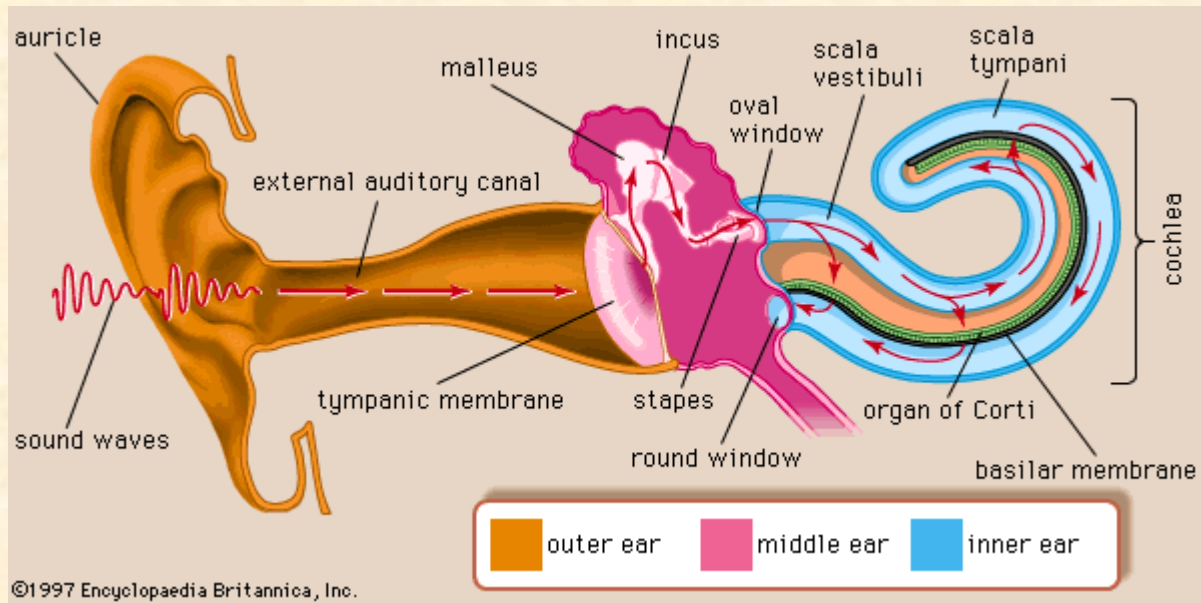


CRISTA AMPULLARIS: sensory organ of **ROTATION**

MACULAE in utricle and saccule: perception of **CHANGE** of head position towards the body position

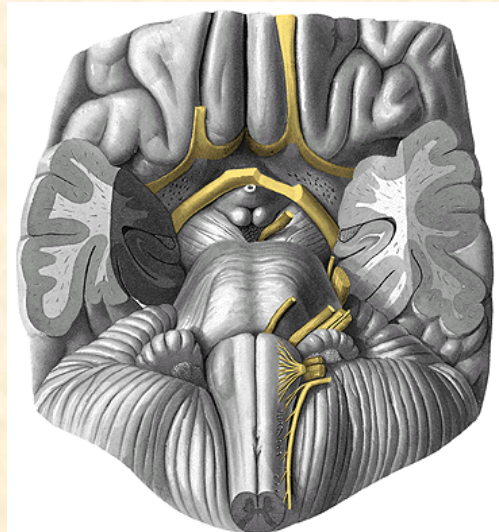
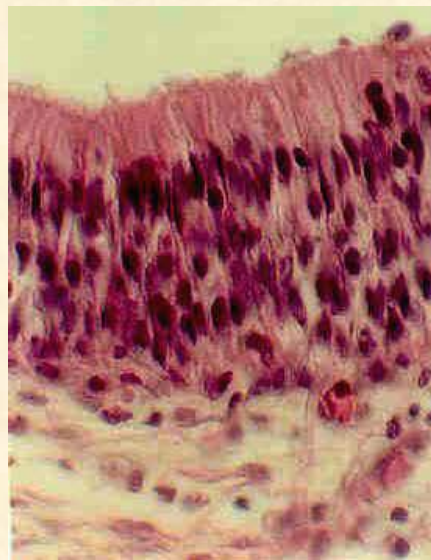
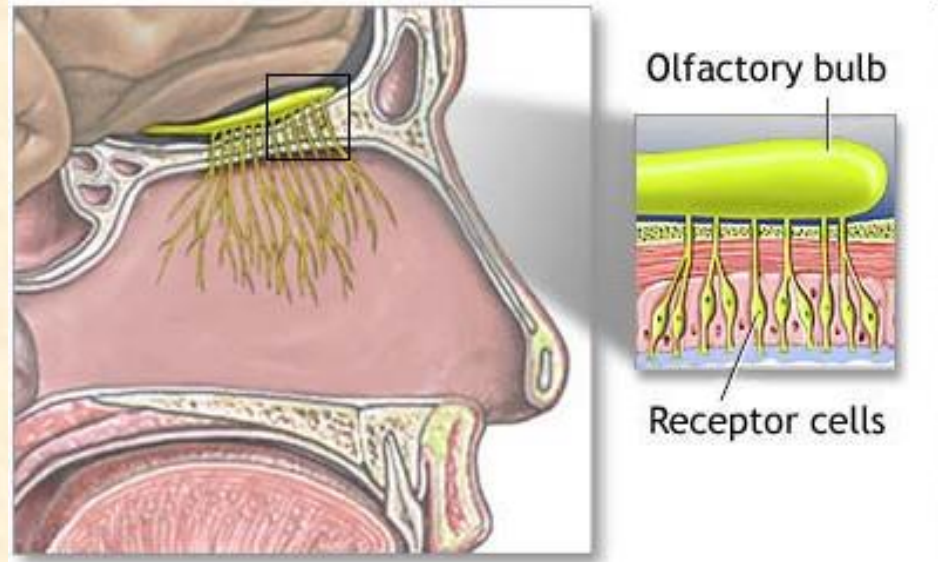
Mechanism of Hearing

- sound waves enter the outer ear and go through the external auditory canal until they reach the tympanic membrane, causing the membrane and the attached chain of auditory ossicles to vibrate
- the motion of the stapes against the oval window sets up waves in the fluids of the cochlea, causing the basilar membrane to vibrate, this stimulates the sensory cells of the organ of Corti to send nerve impulses to the brain



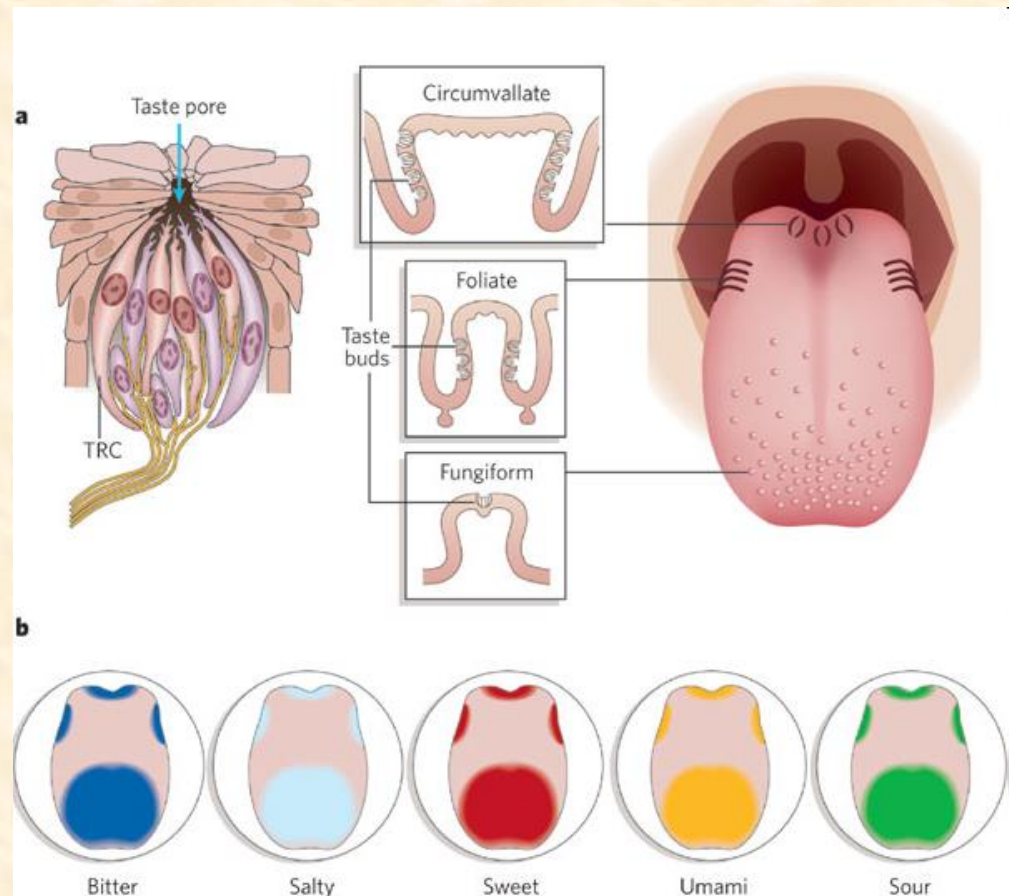
Organ of Smell/Olfaction

- mucous membrane of nasal cavity
 - olfactory cells
 - supportive cells
- olfactory nerves
- olfactory bulb
- olfactory tract
- rhinencephalon



Organ of Taste/Gustation

- taste buds in oral cavity
- there is a termination of sensory nerves (facial, glossopharyngeal and vagus nerve)



Receptors

EXTERORECEPTORS

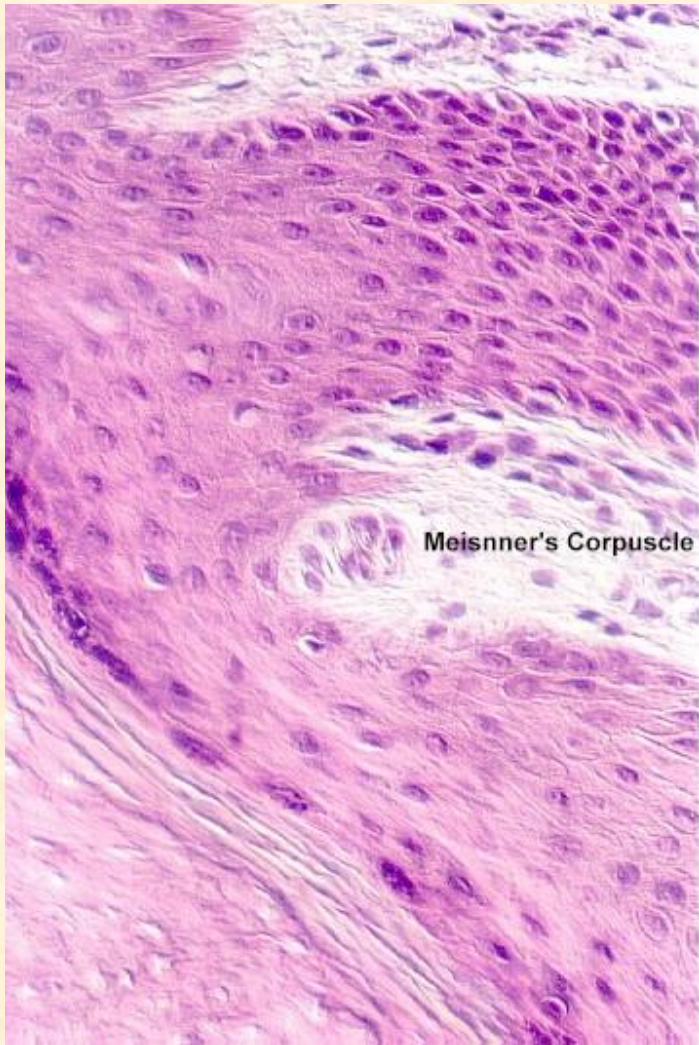
INTERORECEPTORS

- **proprioceptors**
 - Golgi tendon organ (tension of tendon)
 - muscle spindle (tension of muscles)
- **visceroreceptors** (in internal organs) – pain, pressure

SKIN RECEPTORS

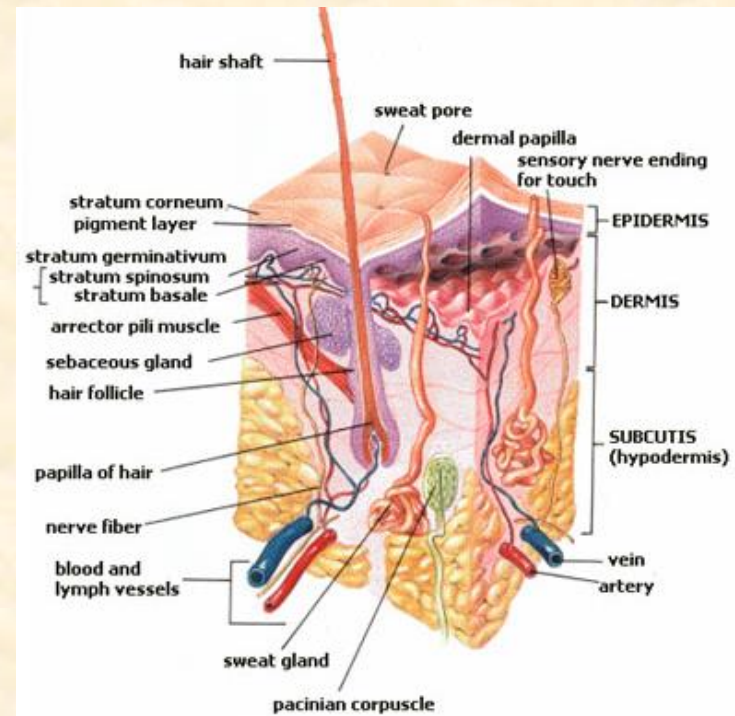
- **Vater-Pacini corpuscles** – pressure changes and vibration
- **Meissner's corpuscles** – sensitivity to light touch
- **Ruffini corpuscle** – warm
- **Krause corpuscle** – cold
- **free nerve endings** – pain

Skin Receptors



Skin

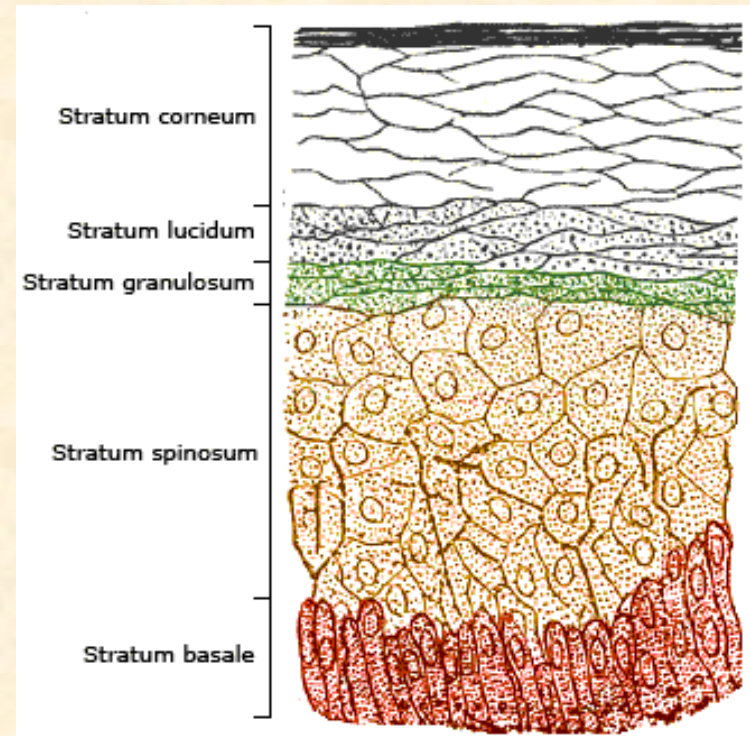
- total area of 1,6 – 2,0 m²
- anatomical barrier from pathogens and damage between the internal and external environment
- skin senses (receptors)
- heat regulation (thermoregulation)
- metabolism
- storage and synthesis (fats, water)
- vitamin D
- aesthetics and communication



Skin

1) EPIDERMIS

- composed of terminally differentiated stratified squamous epithelium
- **stratum basale** (germinativum)
 - germinal layer, melanocytes
- **stratum spinosum**
 - the strongest layer, mechanical resistance
- **stratum granulosum**
 - keratohyalin granules
- **stratum lucidum**
 - light-coloured strip, conversion of keratohyalin into glycogen and eleidin
- **stratum corneum**
 - cornified, nucleusless scales



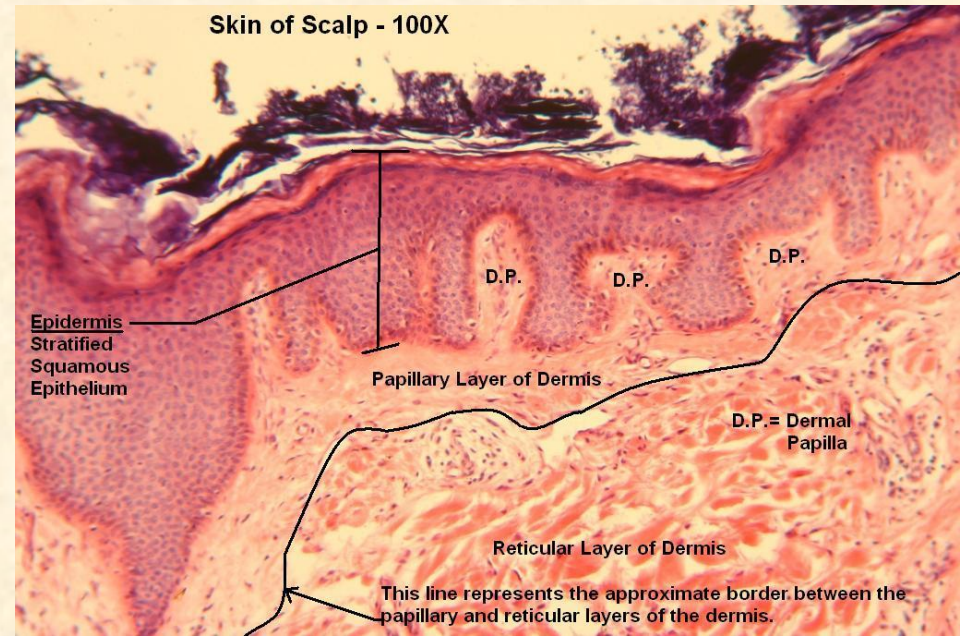
Skin

2) DERMIS

- **papillary dermis** – surface layer, skin papillae, elastic fibres
- **reticular dermis** – deep layer, collagen fibres

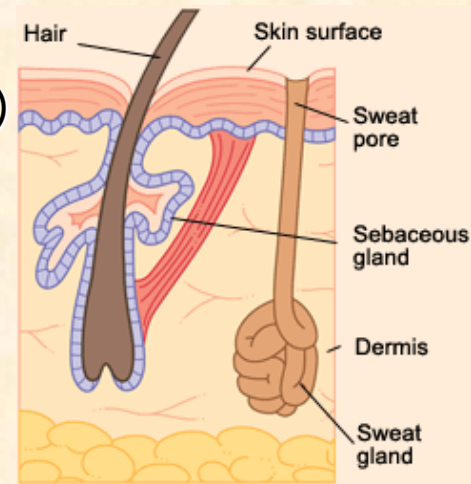
3) HYPODERMIS (subcutaneous adipose layer)

- net of the loose collagen fibrous tissue with adipose cells
- fat storage

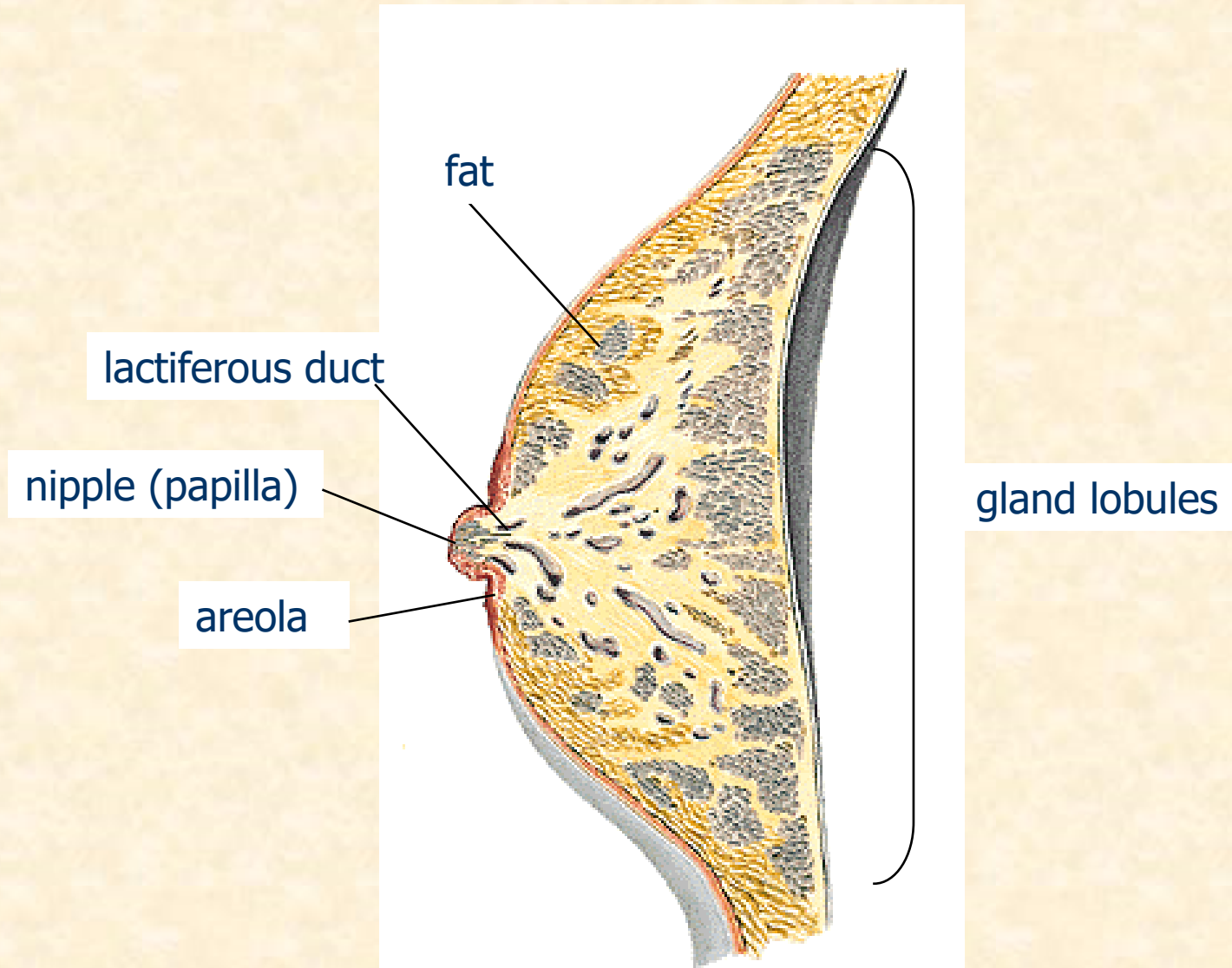


Skin Appendages

- **SEBACEOUS GLANDS** – secrete an oily/waxy matter called sebum, they are found mostly on the scalp and face, sebum acts to protect and waterproof hair and skin and keeps them from becoming dry, inhibits the growth of the microorganisms
- **SWEAT GLANDS**
 - eccrine – skin on the body, palms and soles have the highest number
 - apocrine – in the axillae, around the nipple and in the groin, may also contain odour substances (pheromones)
- **MAMMARY GLAND** – modified apocrine sweat gland, 15–20 lobules + adipose fibrous tissue



Mammary Gland



Skin Appendages

- **HAIR** – cylindrical, keratinized, often pigmented filaments characteristically growing from follicles deep within the dermis
 - primary – lanugo (fine soft hair in newborn child)
 - secondary – hair, hairs of the body, eyelashes, eyebrows
 - tertiary – beard, hairs in groins and armpits, nasal hairs, hairs in the auditory meatus
- **NAIL** – plate made of tough protein (keratin), protecting the tip of the finger

