# SENSE ORGANS

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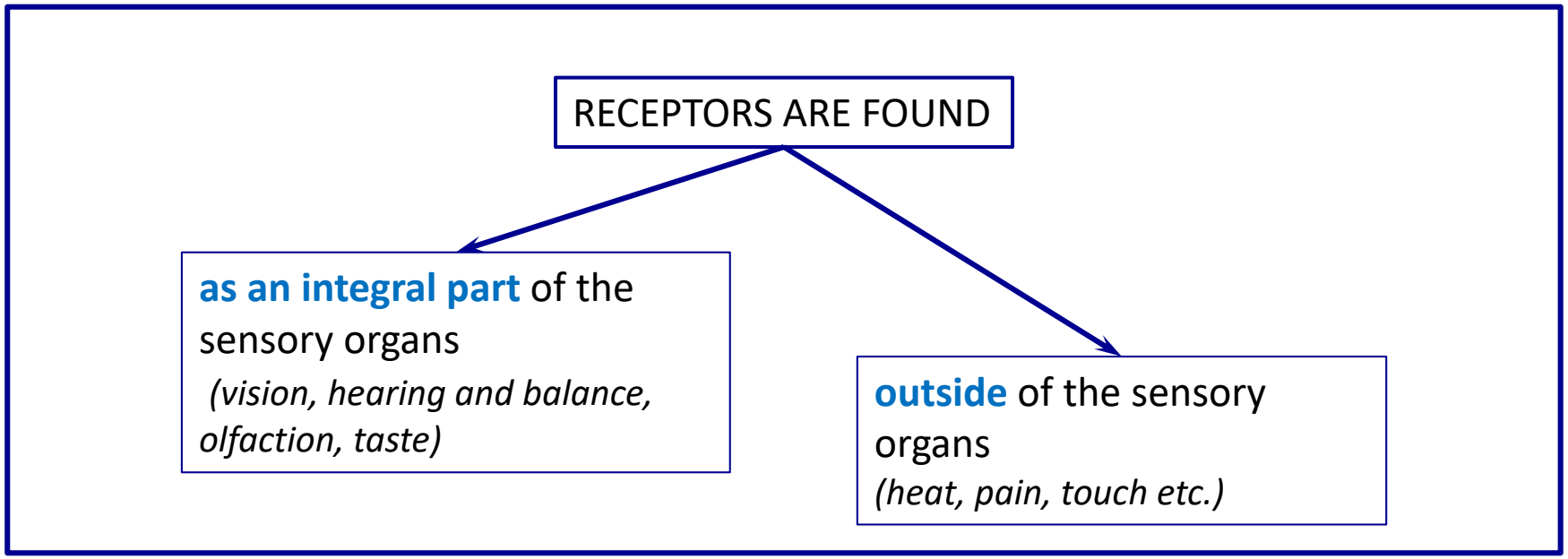
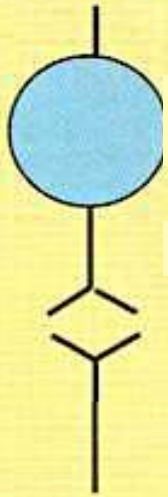
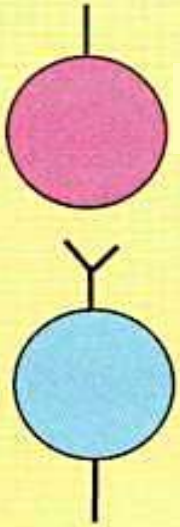
## TYPES OF RECEPTORS:

- mechanoreceptors *(respond to mechanical pressure or stretching: receptors of the organ of hearing and balance, tactile receptors of the skin, muscle spindles and Golgi tendon organs, baroreceptors)*
- chemoreceptors *(receptors of the organs of taste and olfaction, interoceptors of the blood vessels)*
- photoreceptors *(in the retina)*
- thermoreceptors *(in the skin and viscera)*
- nociceptors *(receptors for pain, stimulated by tissue injury: found in various tissues)*



***ORGANS OF SPECIAL SENSES (sensory organs)*** are specialized structures that represent peripheral parts of the analyzers and contain receptors reacting to external or internal stimuli

## ORGANS OF SPECIAL SENSES

| I. Primary sensory organs | II. Secondary sensory organs |
|---|---|
| **RECEPTOR CELLS** | **RECEPTOR CELLS** |
| Organ of vision, organ of olfaction | Organ of hearing and balance, organs of taste |
|  Neurosensory cell; Axon |  Sensoepithelial cell; Dendrite; Neuron (cell body); Axon |
| Reception is implemented by specialized **neurons** (neurosensory cells) | Reception is implemented by specialized **epithelial cells** (sensoepithelial cells) |

By embryonic source of origin and by structure ***SENSORY ORGANS*** are subdivided into:

- Type I, or **primary sensory organs** (include the organs of vision and olfaction) contain ***neurosensory receptor cells*** that have *neural source of origin* and are specialized ***neurons***

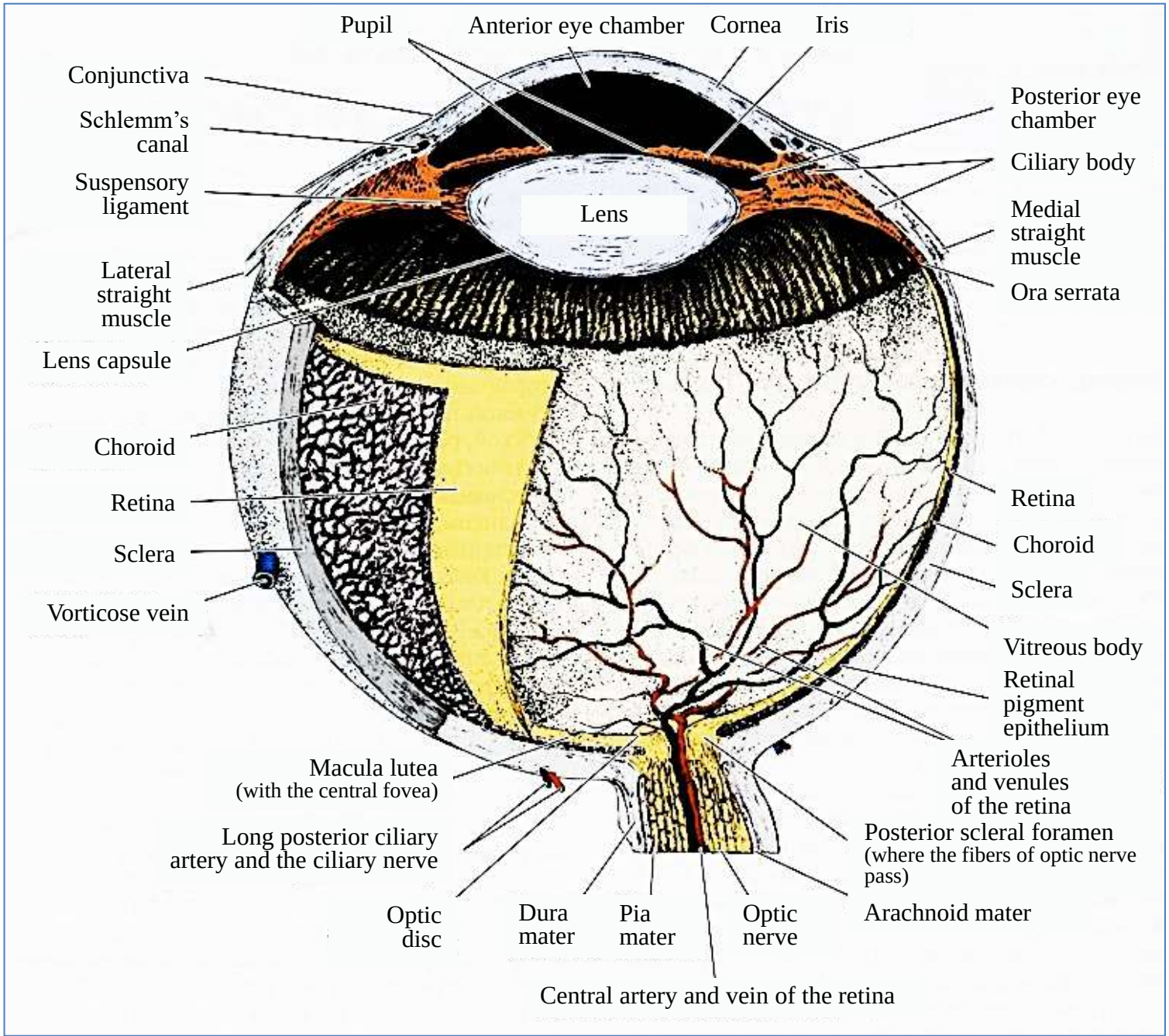
  These cells percept external stimuli by their peripheral process (dendrite) and transmit it to subsequent neurons by their central process (axon)

- Type II, or **secondary sensory organs** (include the organ of hearing and balance and the organs of taste) contain ***sensoepithelial receptor cells*** that originate from the *ectodermal placodes*

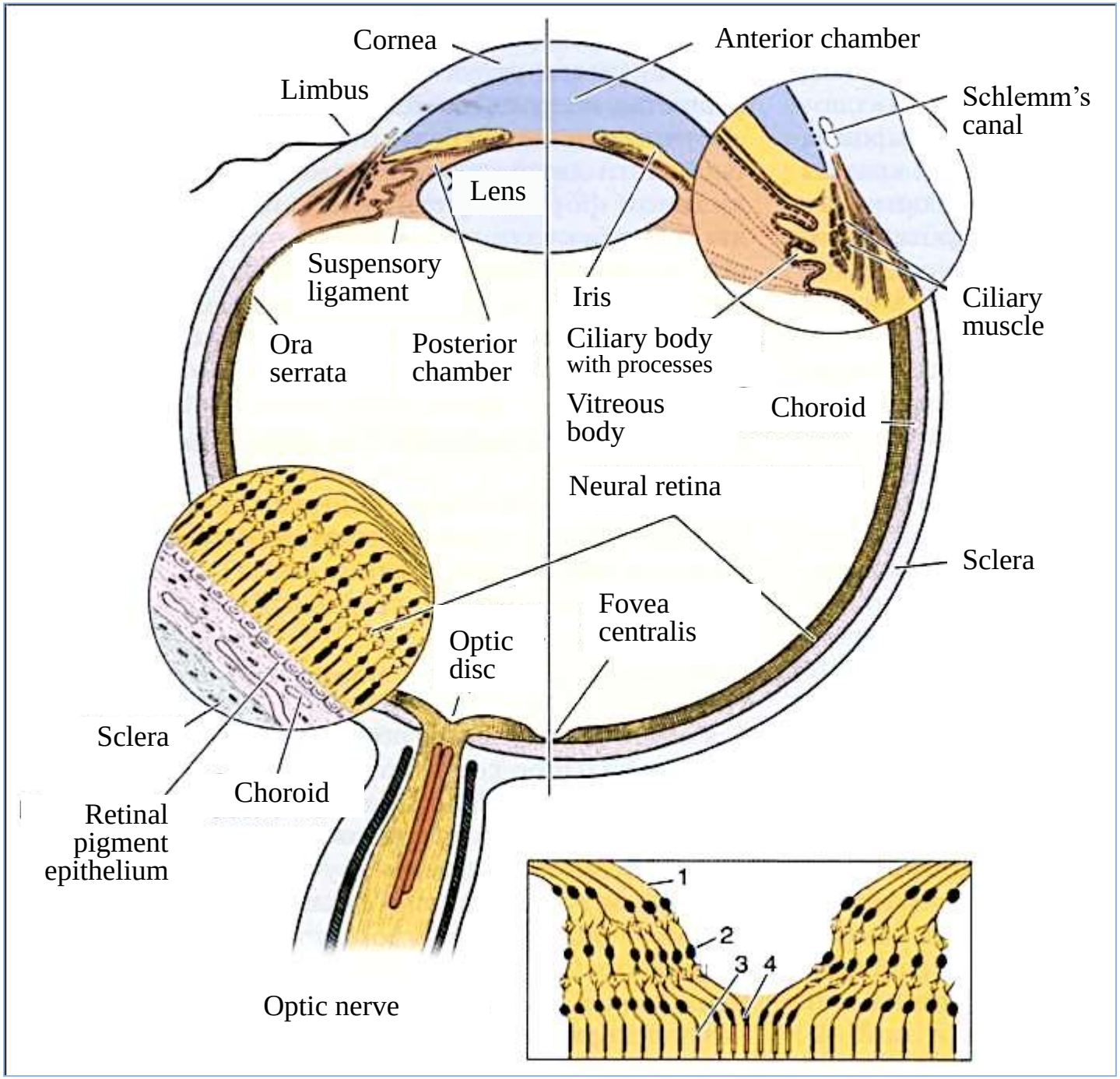
  These cells percept external stimuli and transmit the excitation to the dendrites of the sensory neurons (which belong to the sensory ganglia)

# ORGAN OF VISION

# ANATOMY OF THE EYE



# ANATOMY OF THE EYE



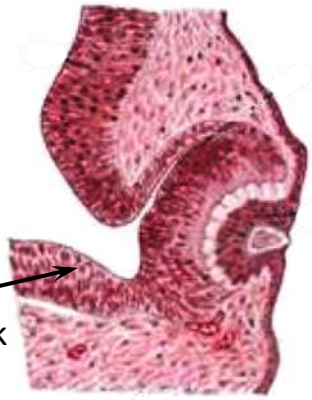
# *DEVELOPMENT OF THE EYE*

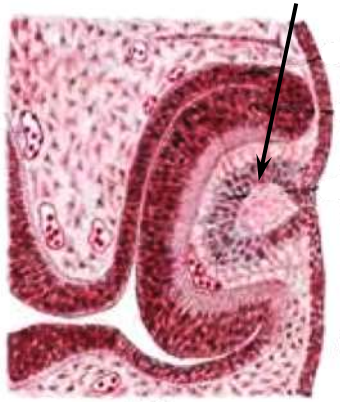
3rd week

optic grooves

ectoderm

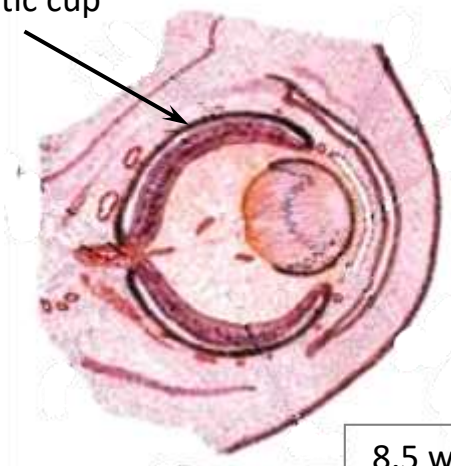
optic stalk





lens vesicle

2 layers of the optic cup

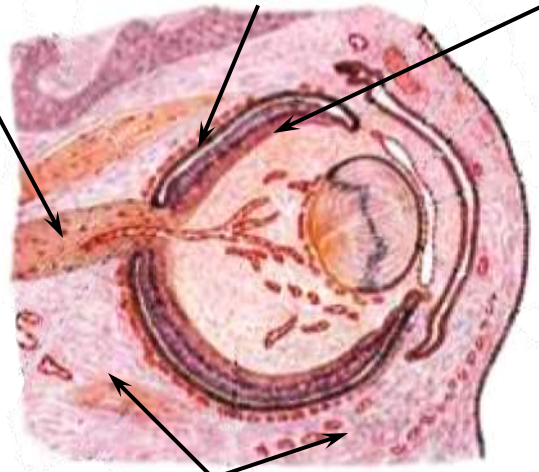


8.5 weeks

optic nerve

a layer of pigment epithelium

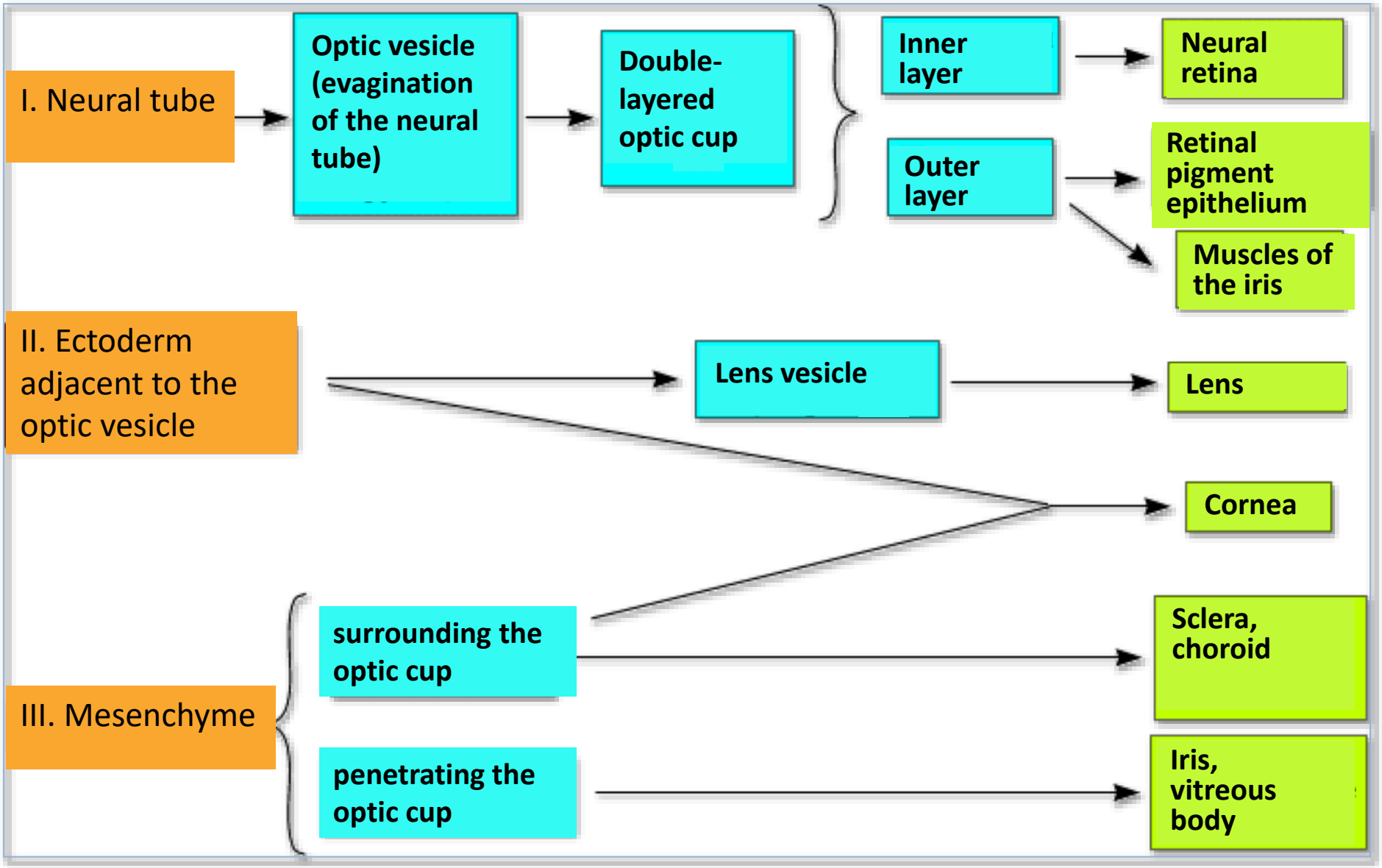
layers of the retina



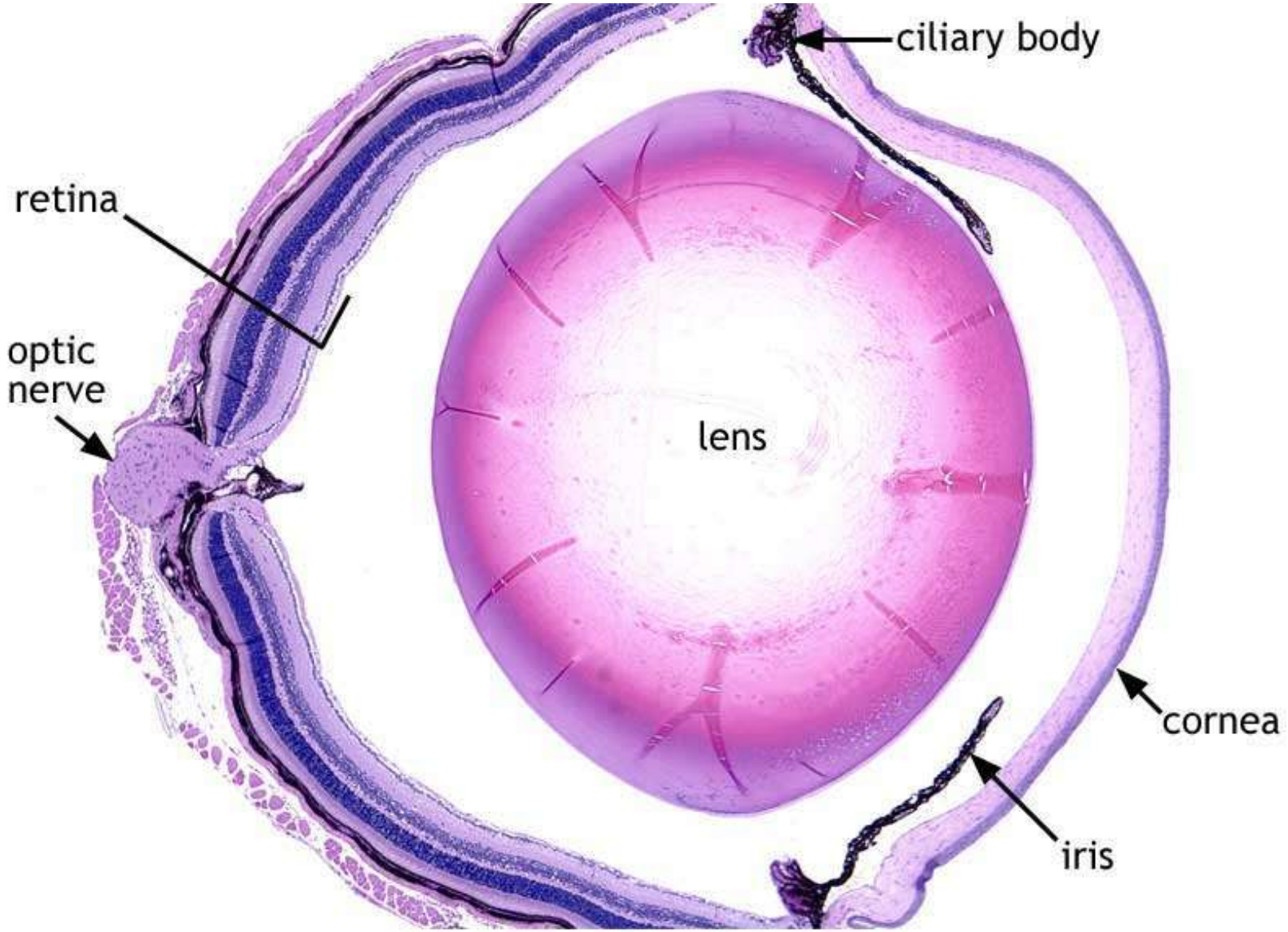
mesenchyme

9.5 weeks

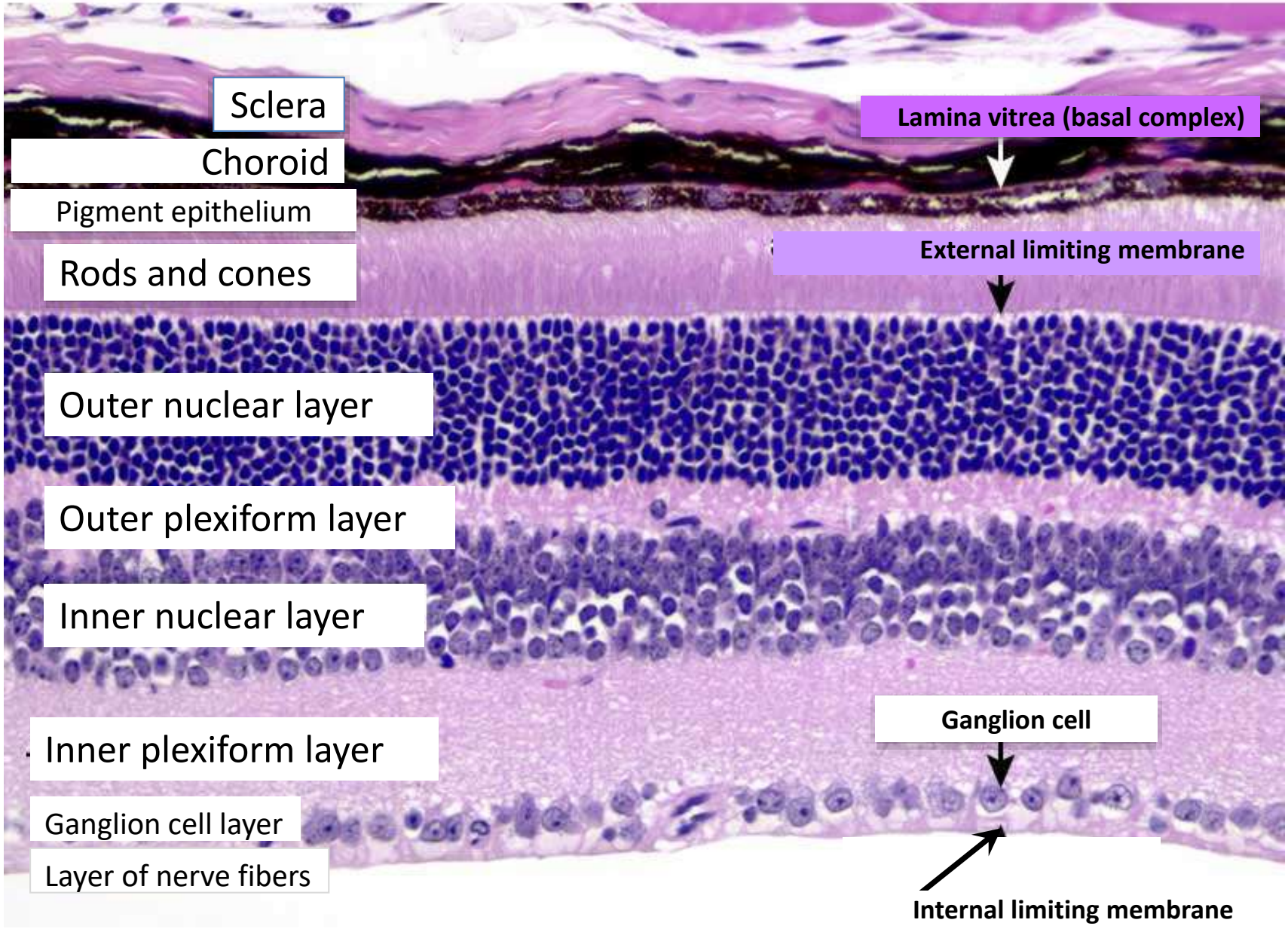
# *DEVELOPMENT OF THE EYE*



# DEVELOPMENT OF THE EYE



# MICROANATOMY OF THE RETINA



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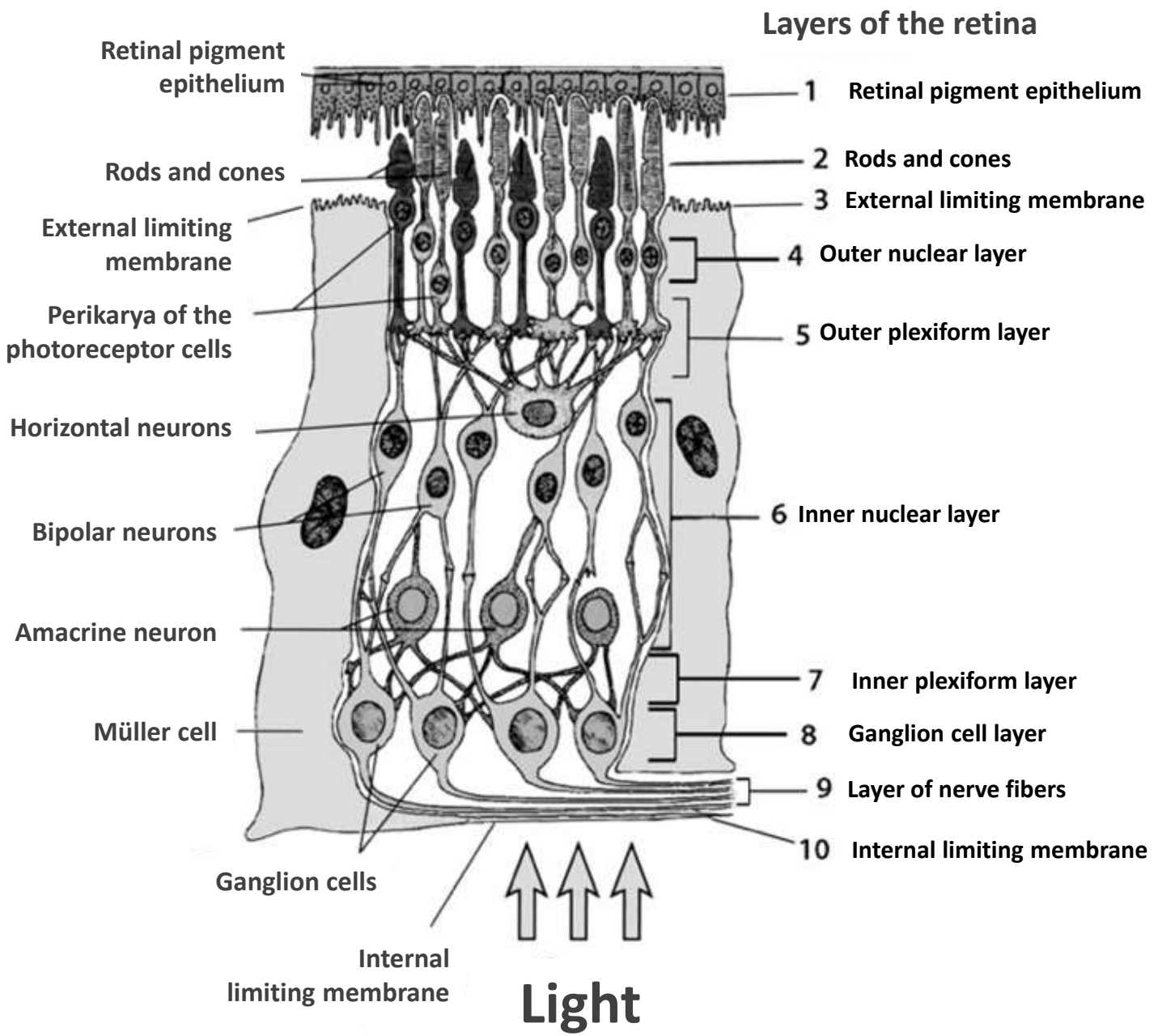
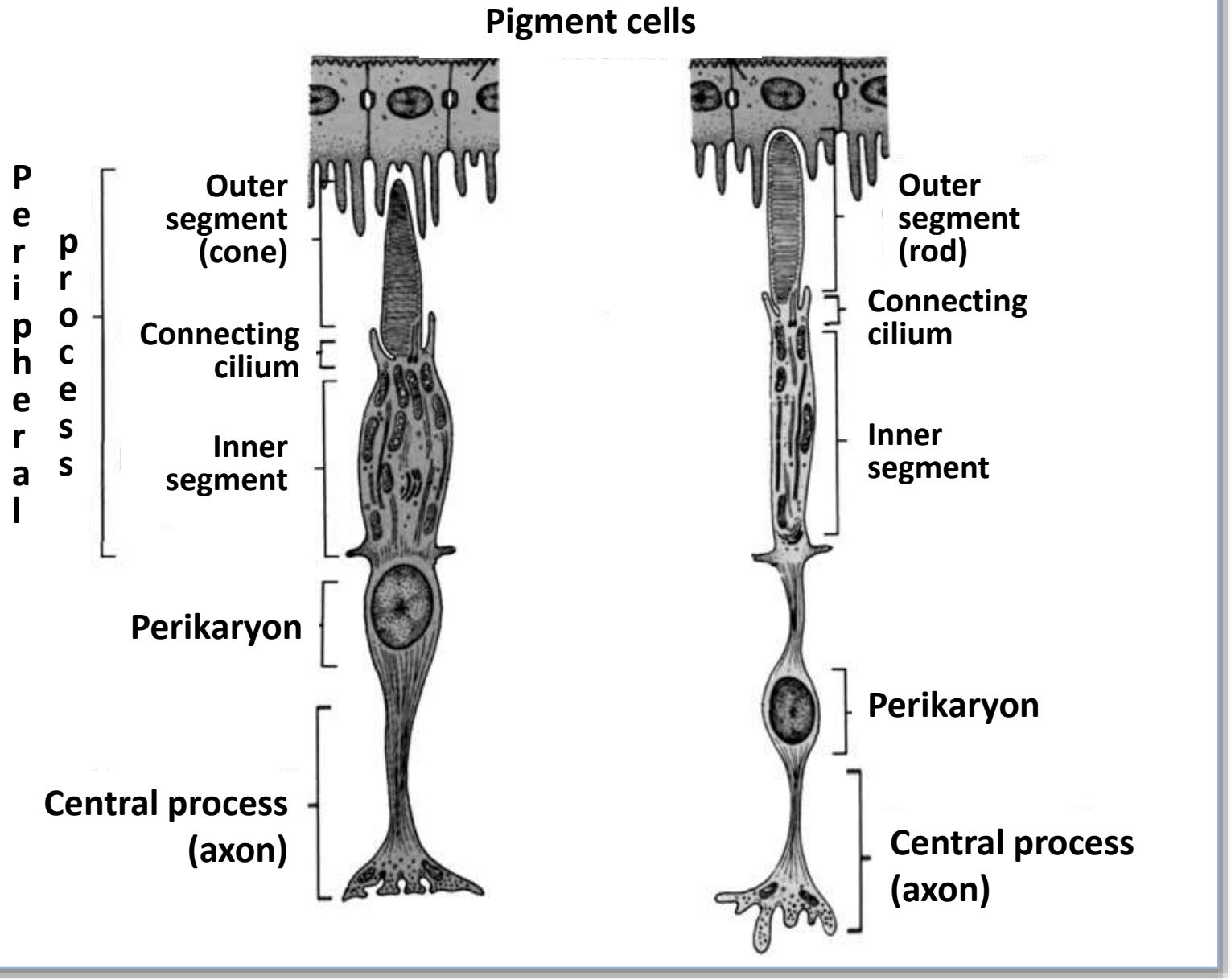
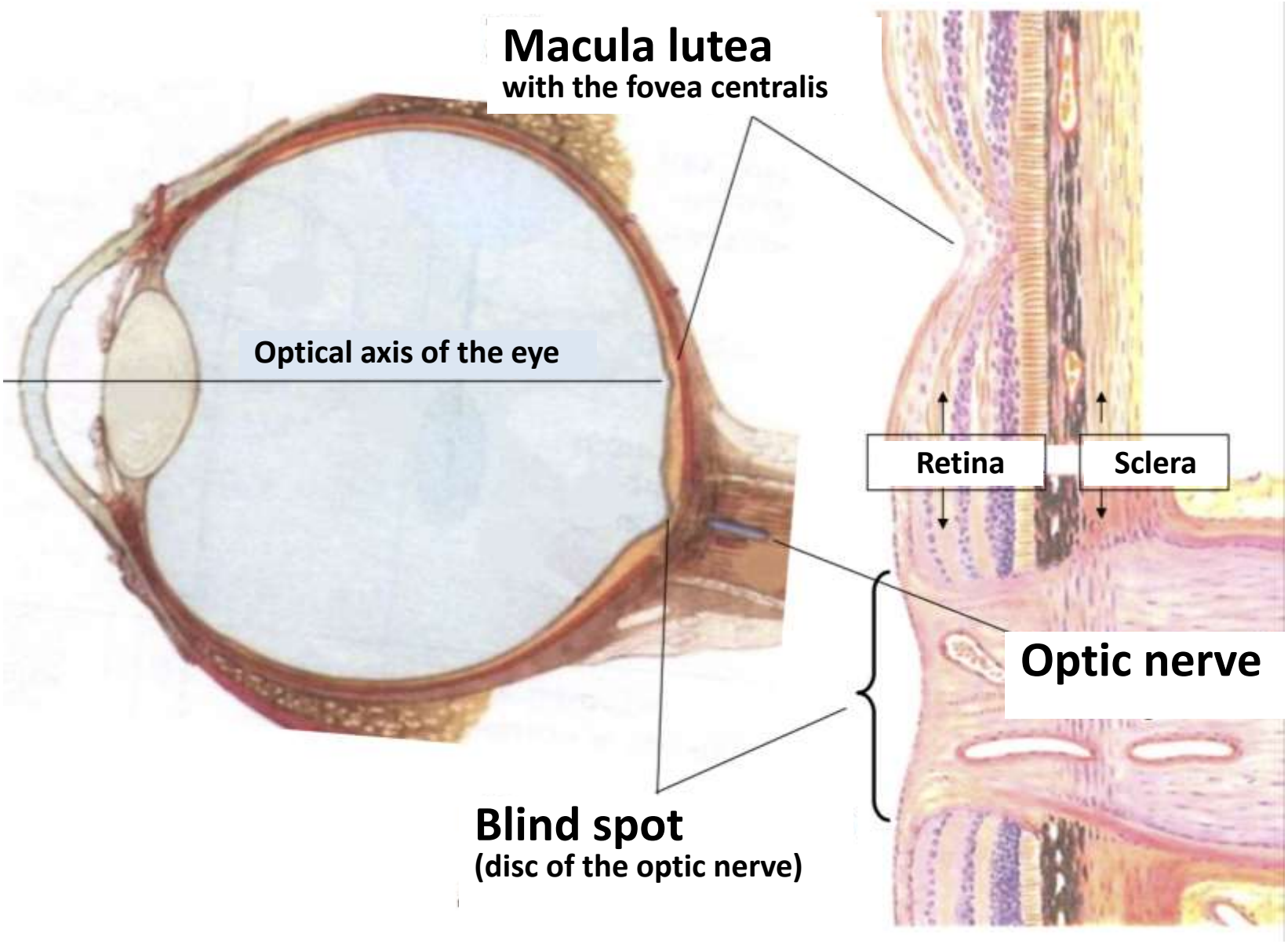


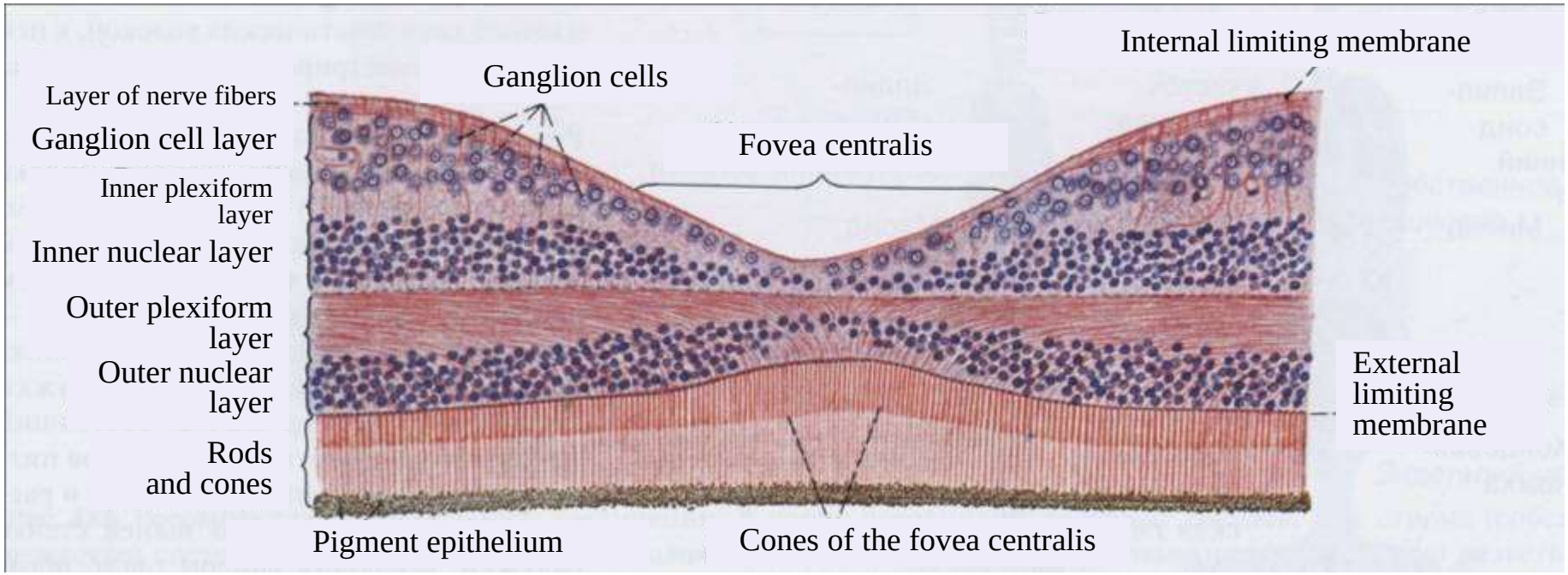
# STRUCTURE OF THE PHOTORECEPTOR CELLS



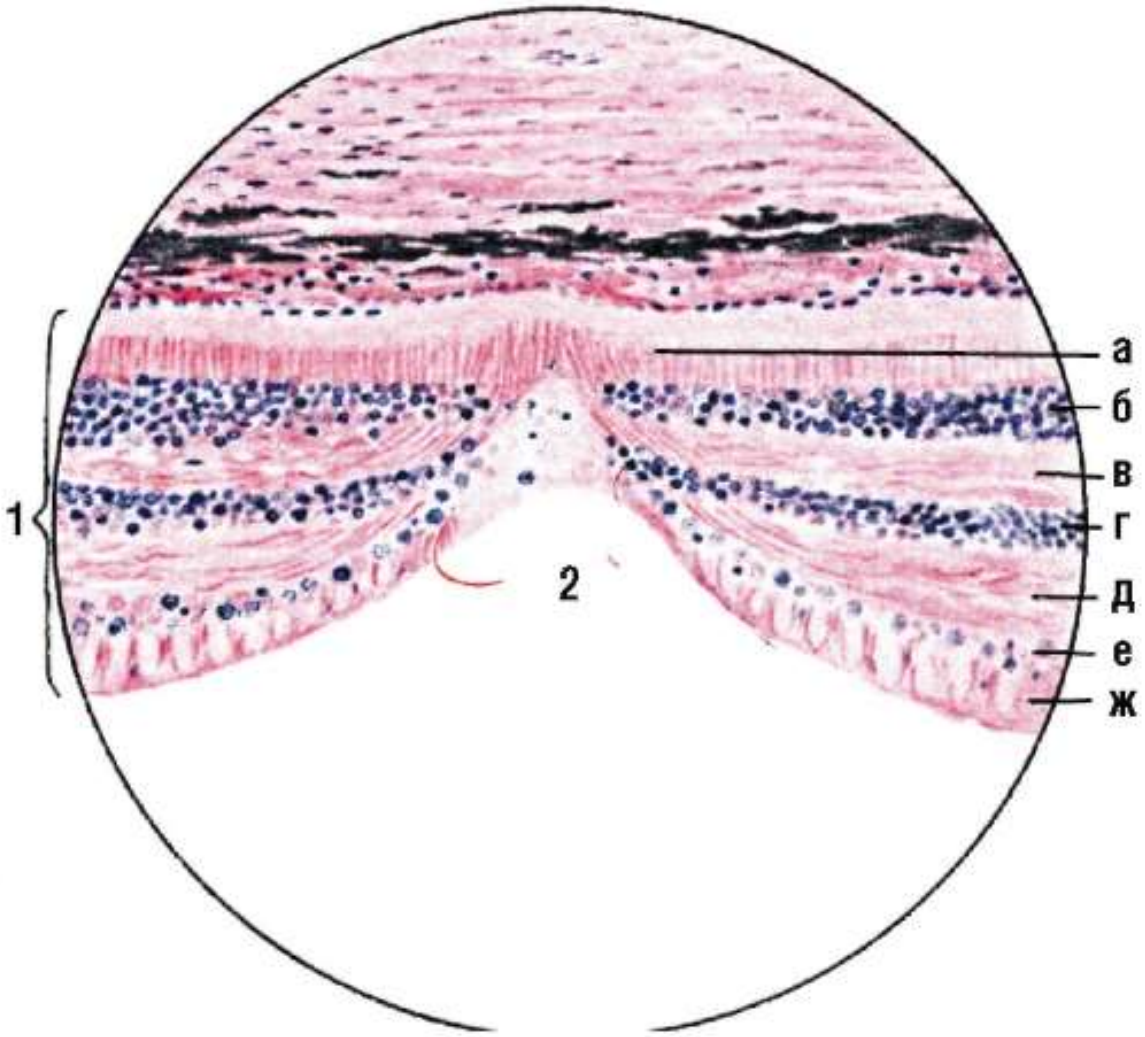
# *ANATOMY OF THE RETINA*



# *MACULA LUTEA WITH THE FOVEA CENTRALIS*

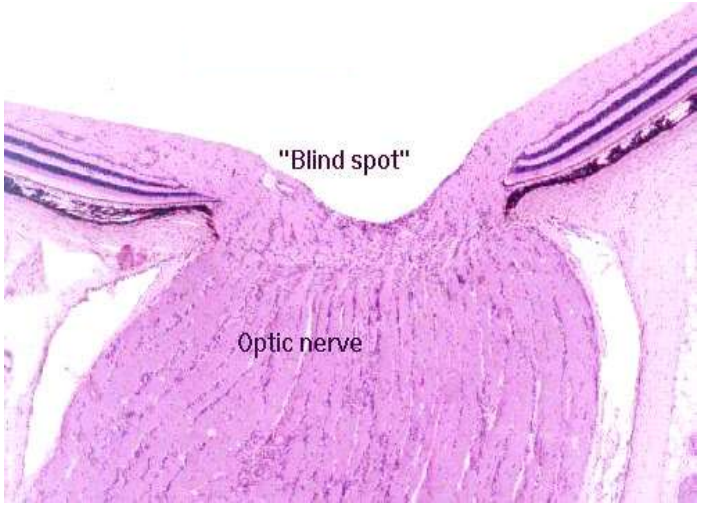


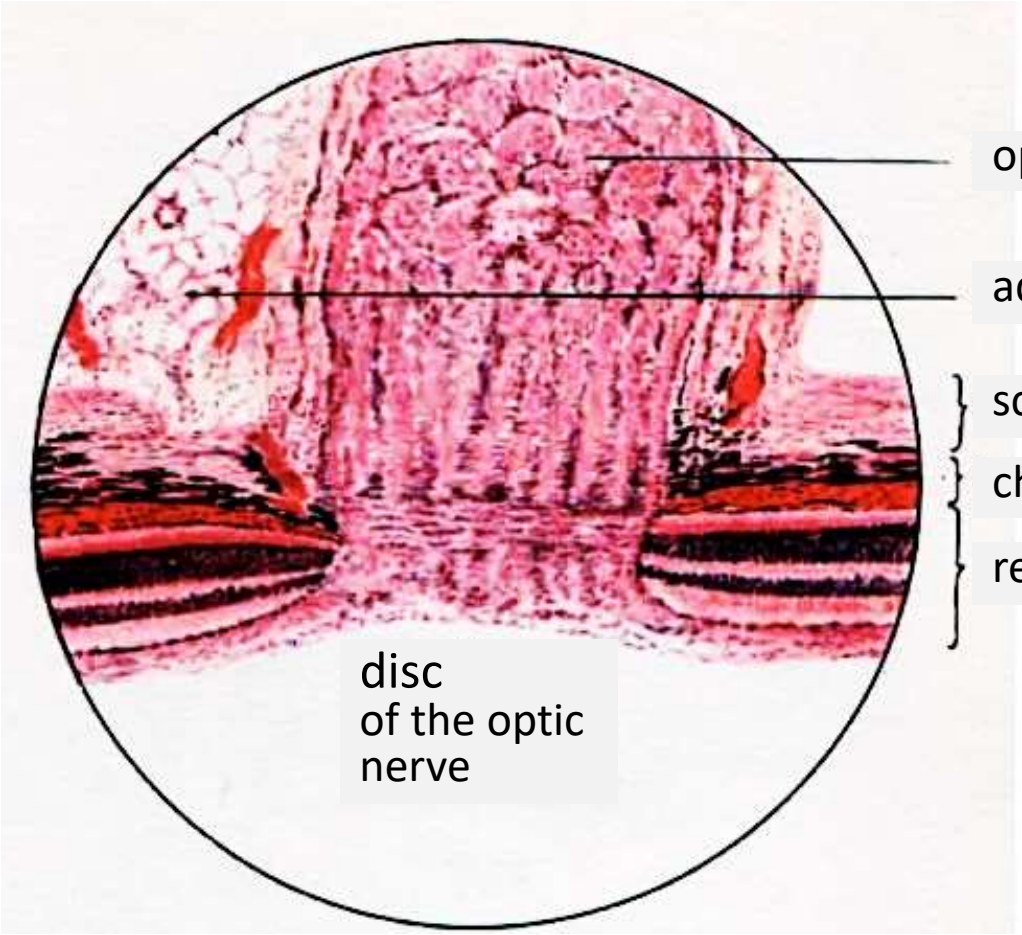
*IDENTIFY THE STRUCTURES,*
*DESCRIBE THEIR COMPOSITION*



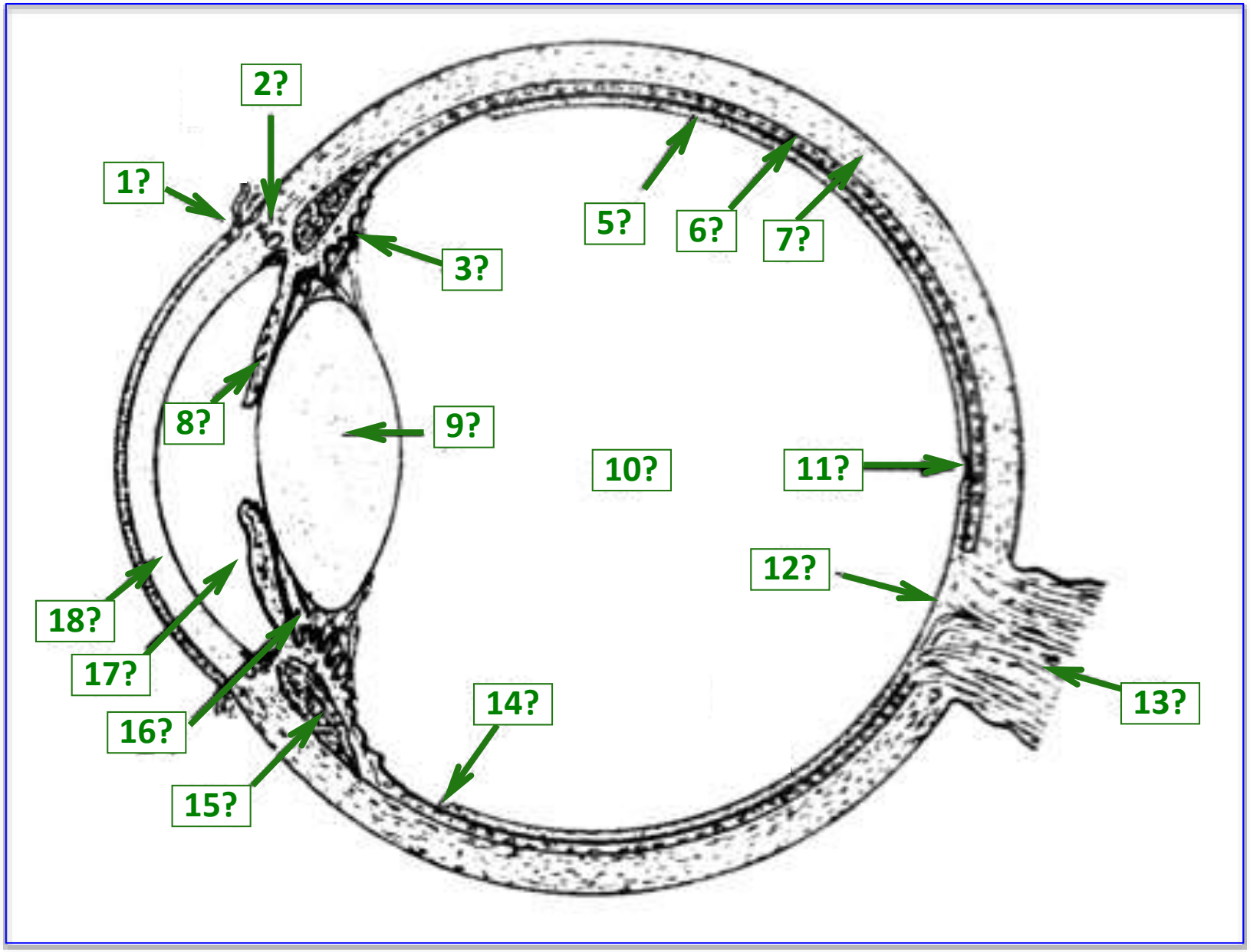
# *BLIND SPOT*

*(DISC OF THE OPTIC NERVE, OPTIC PAPILLA)*



*IDENTIFY THE STRUCTURES AND DESCRIBE THEIR COMPOSITION*
*WHAT EMBRYONIC SOURCES DO THEY DEVELOP FROM?*



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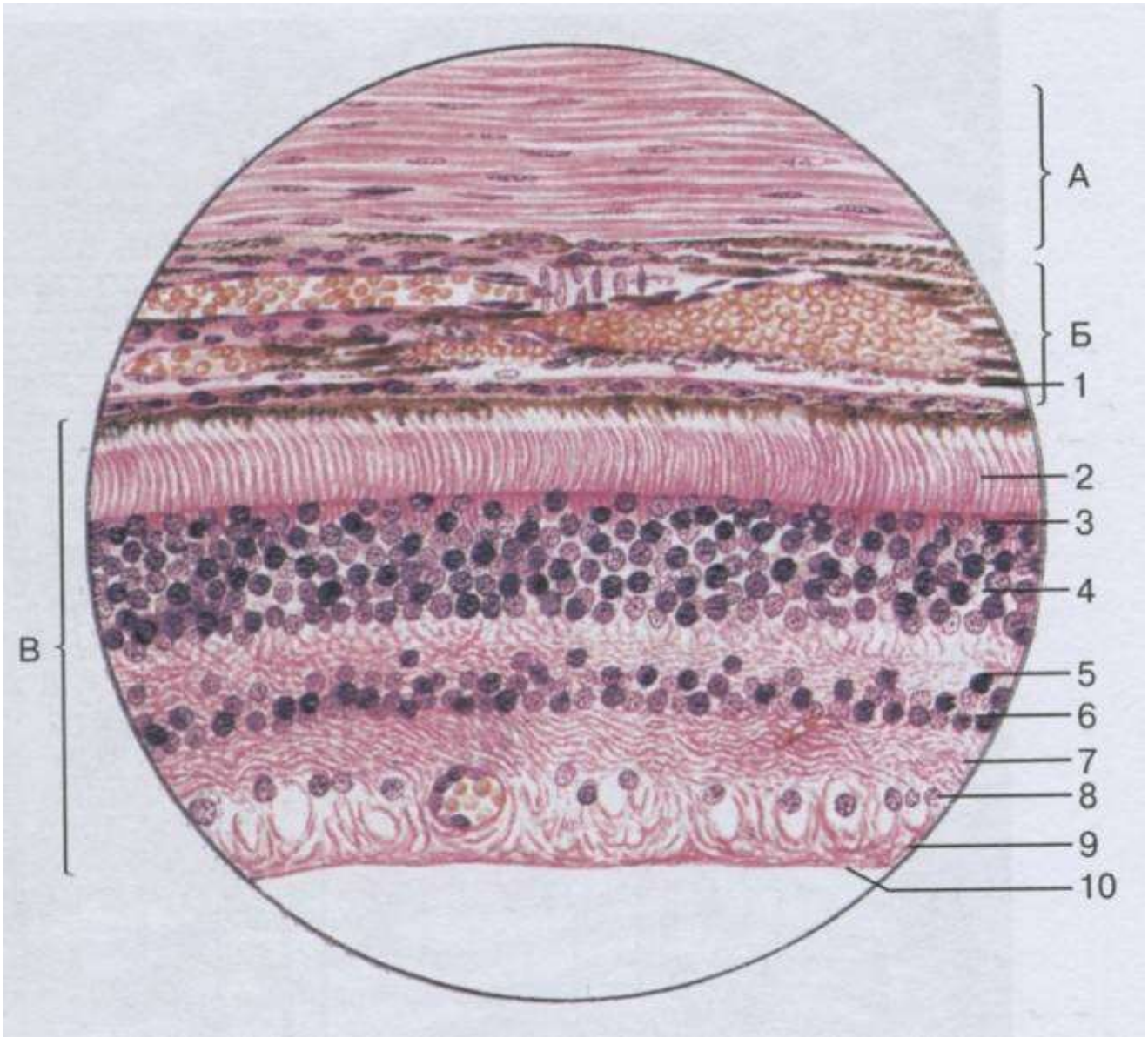
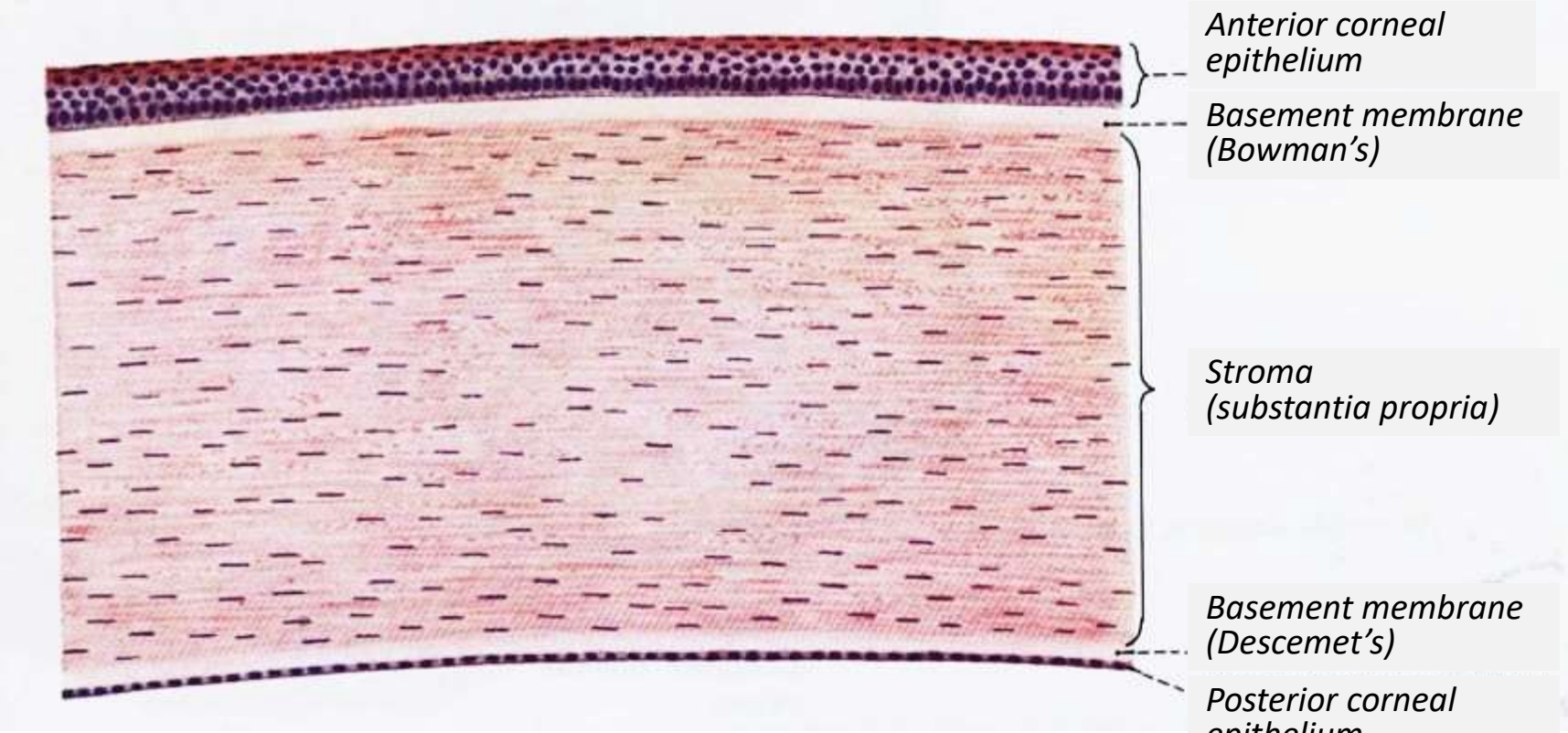


# CORNEA OF THE EYE



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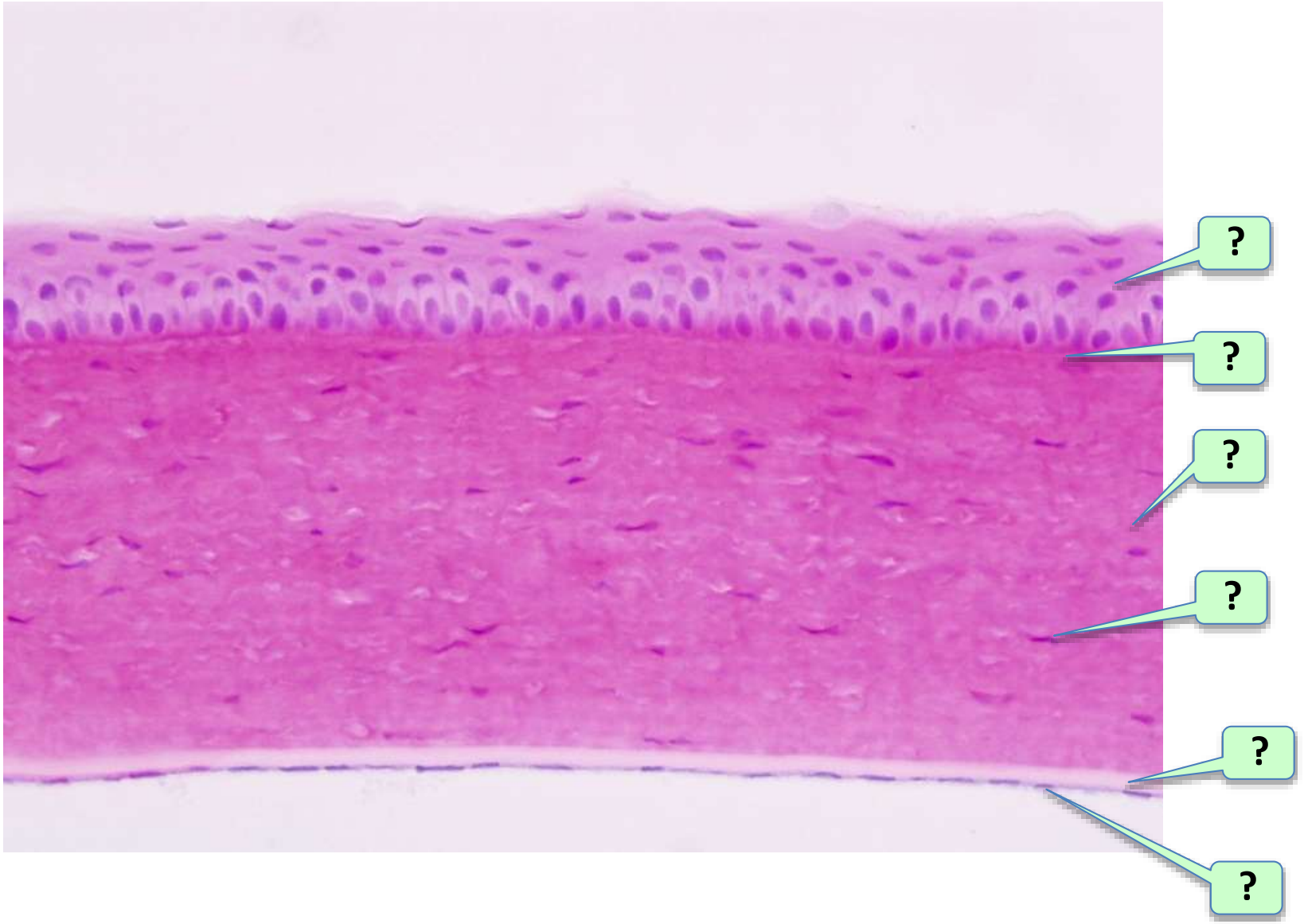
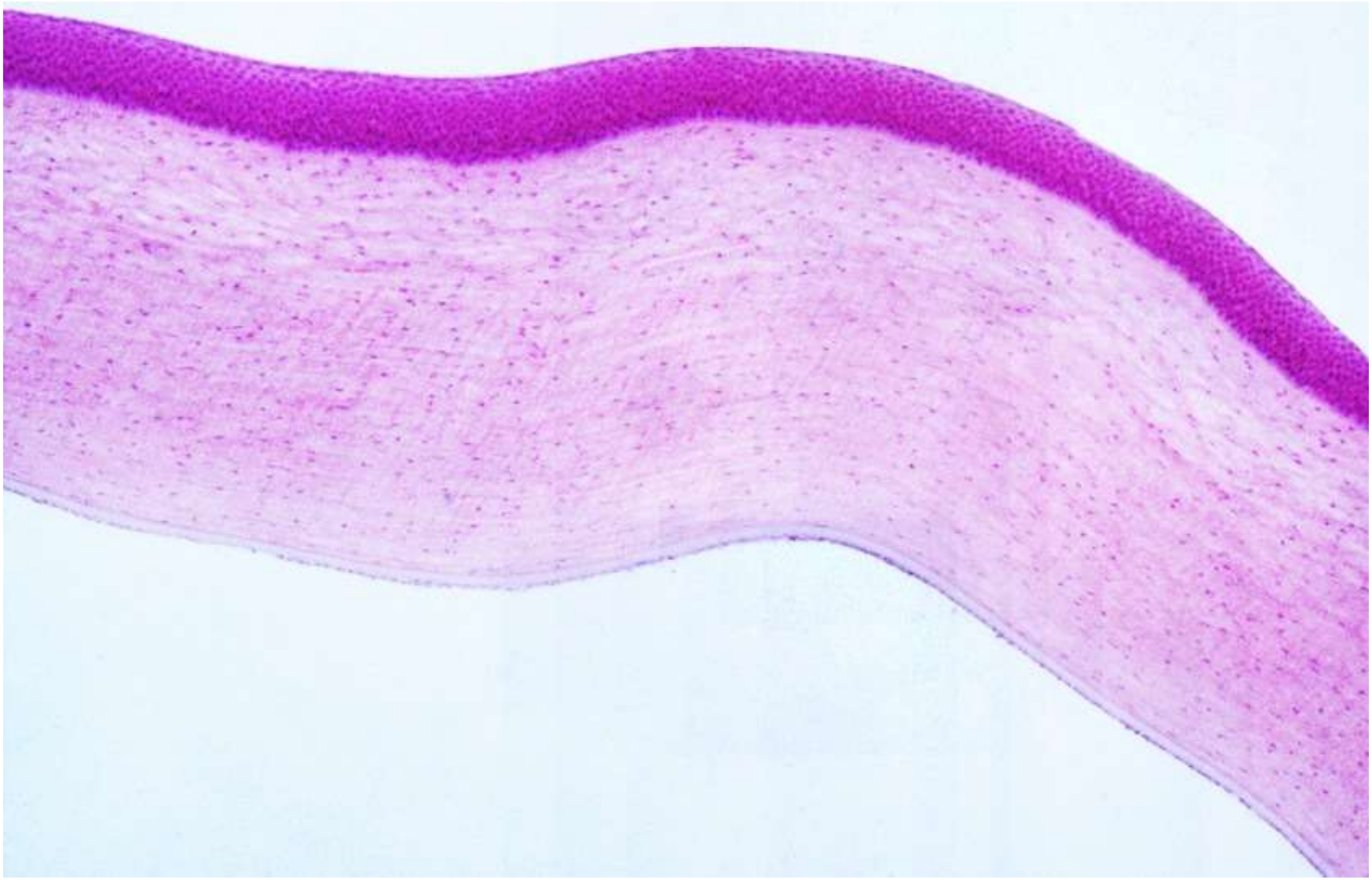


*Slide №93.* Cornea of the eye

*Hematoxylin-eosin staining*



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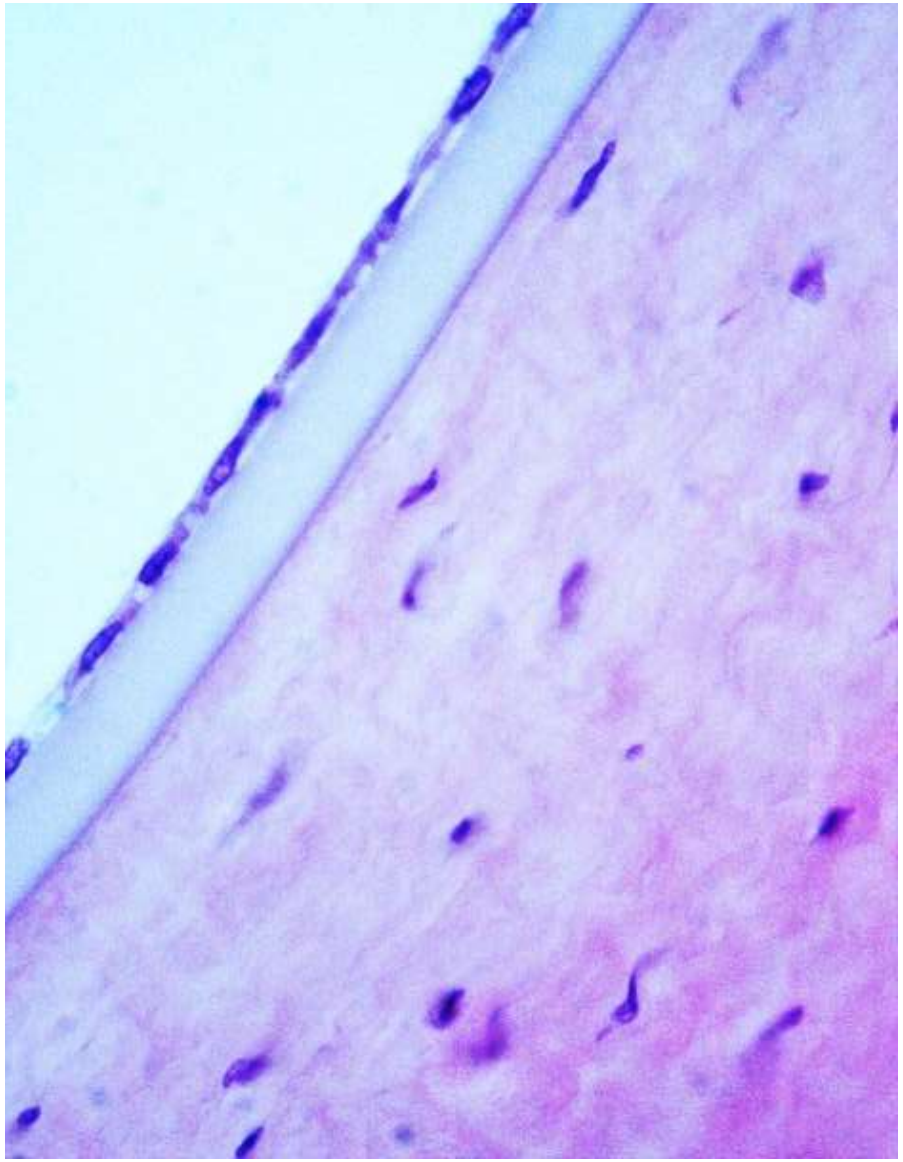
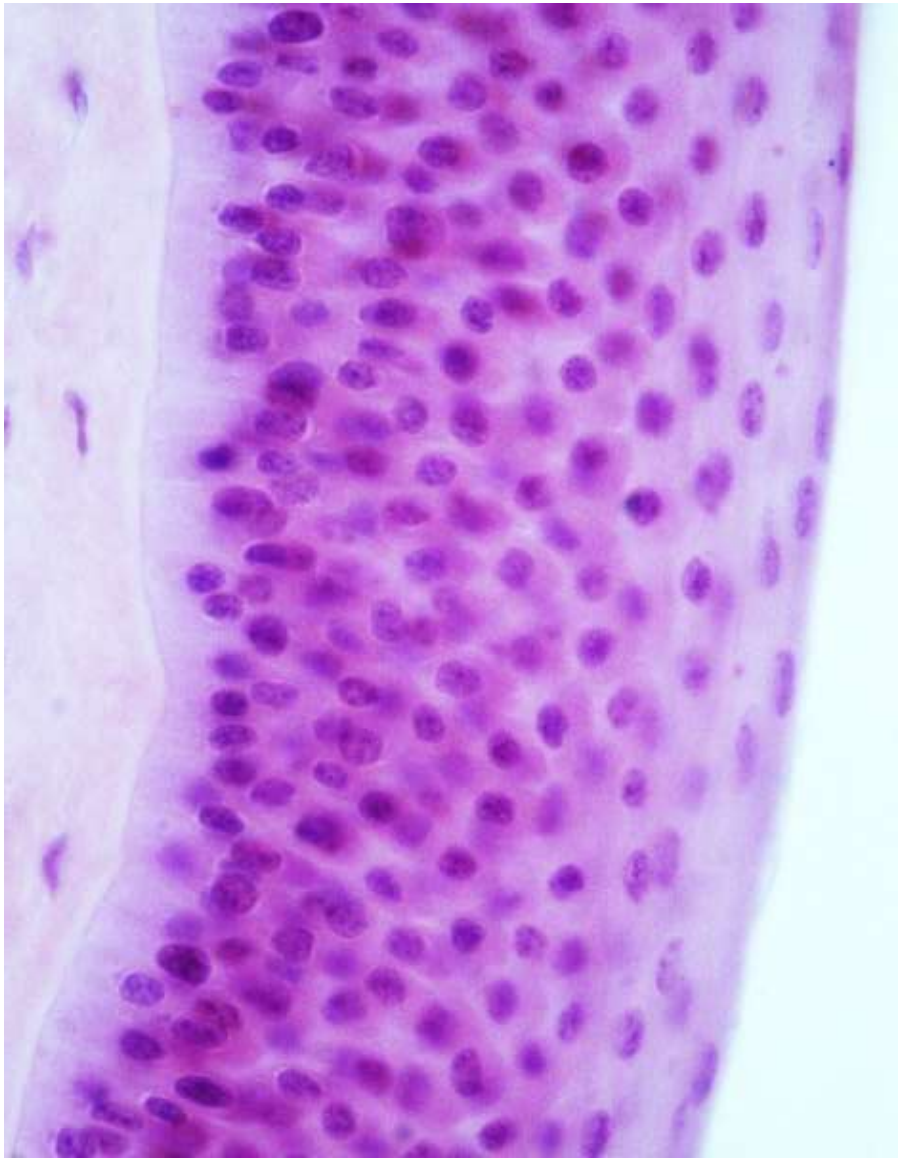
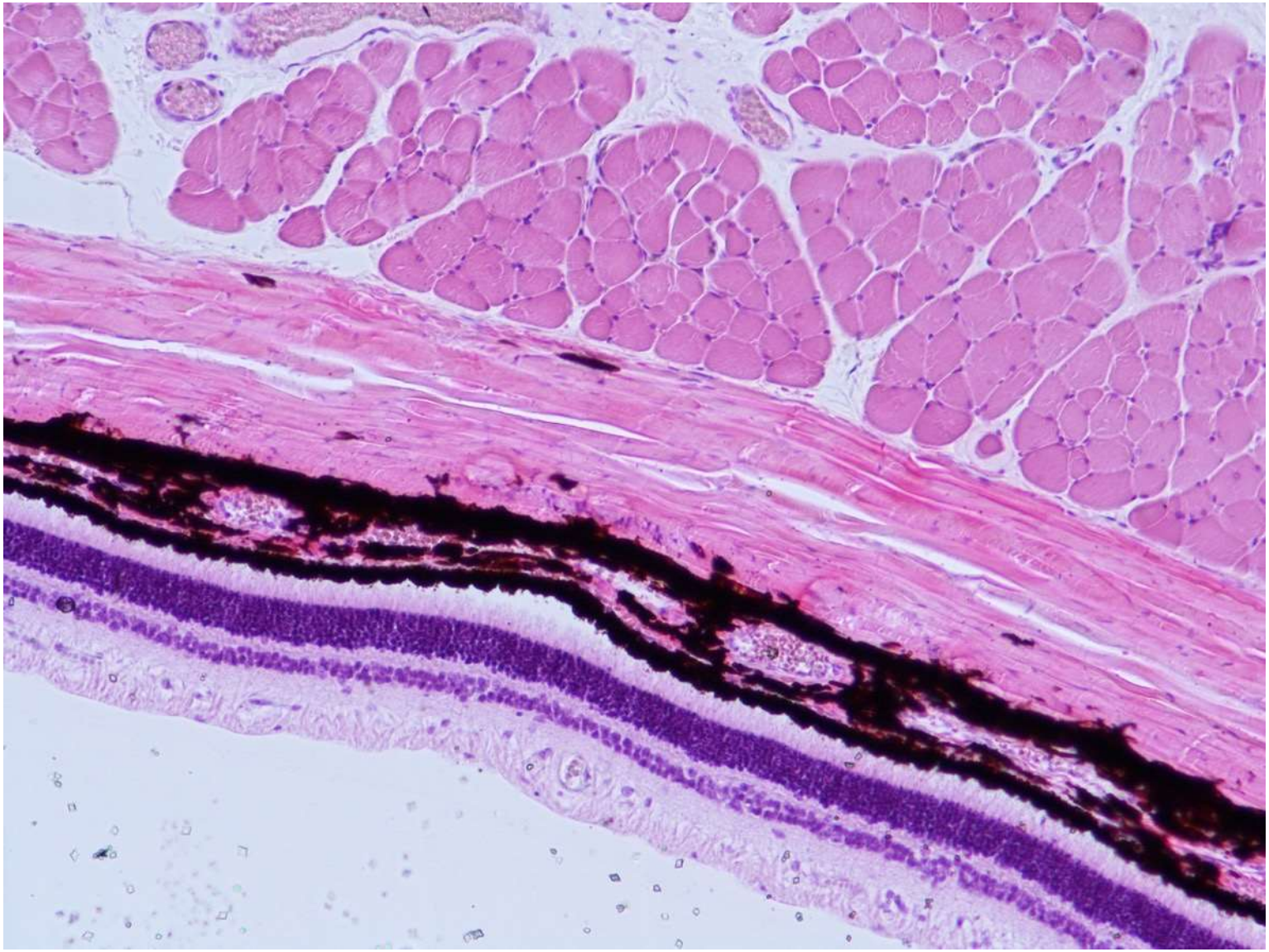
*Hematoxylin-eosin staining*





*Slide №95.* Posterior wall of the eye

*Hematoxylin-eosin staining*



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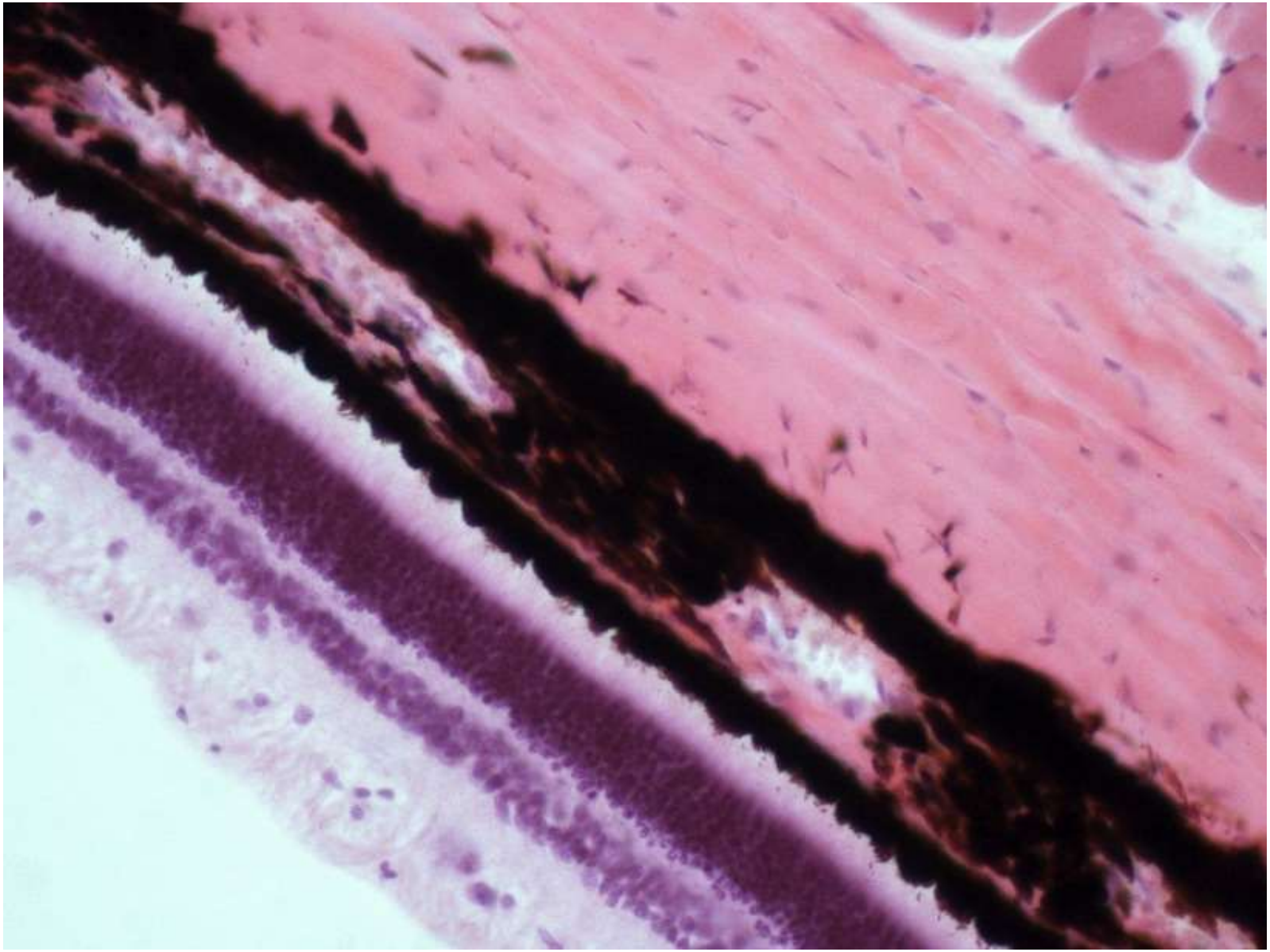

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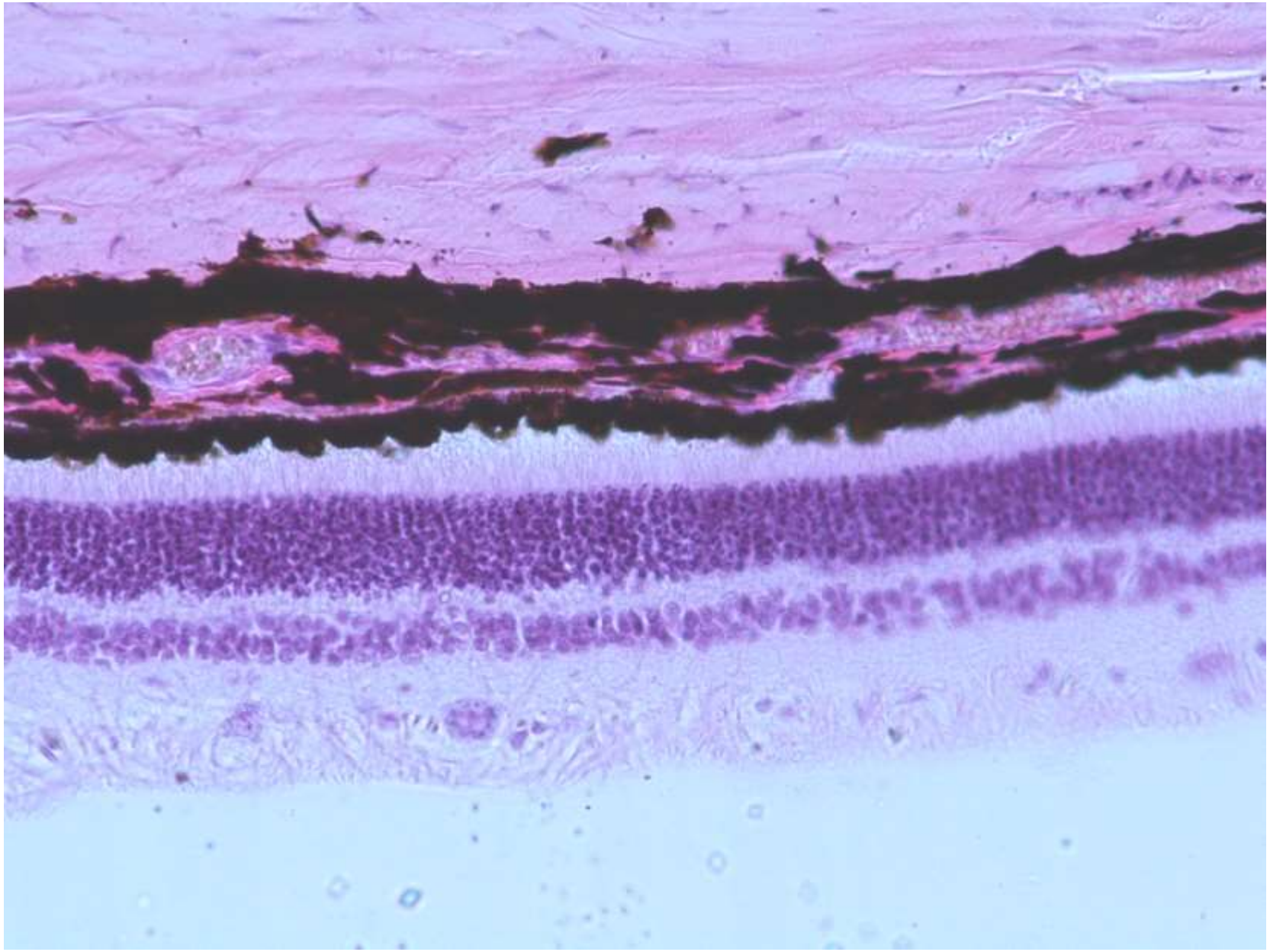
*Hematoxylin-eosin staining*



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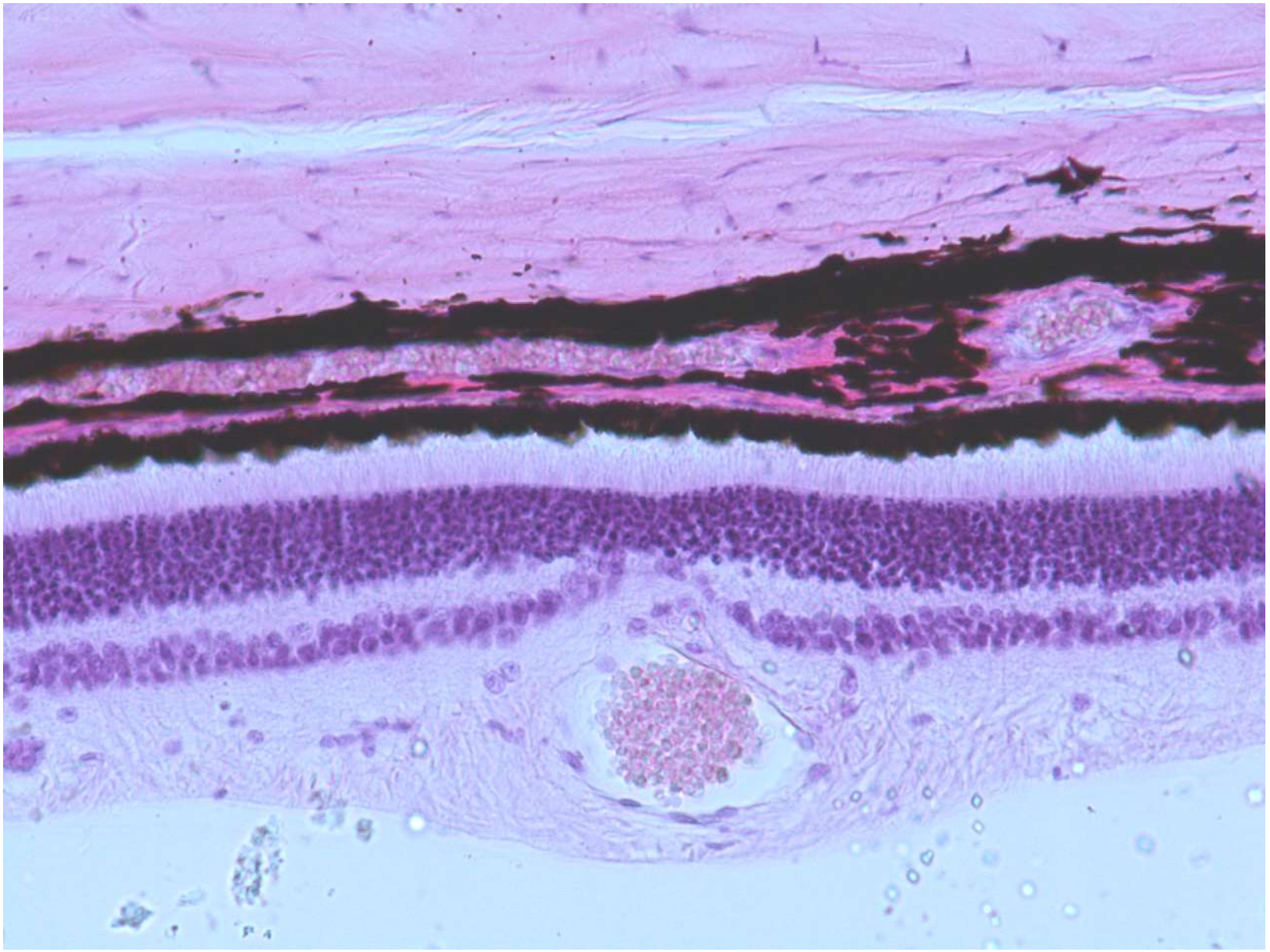

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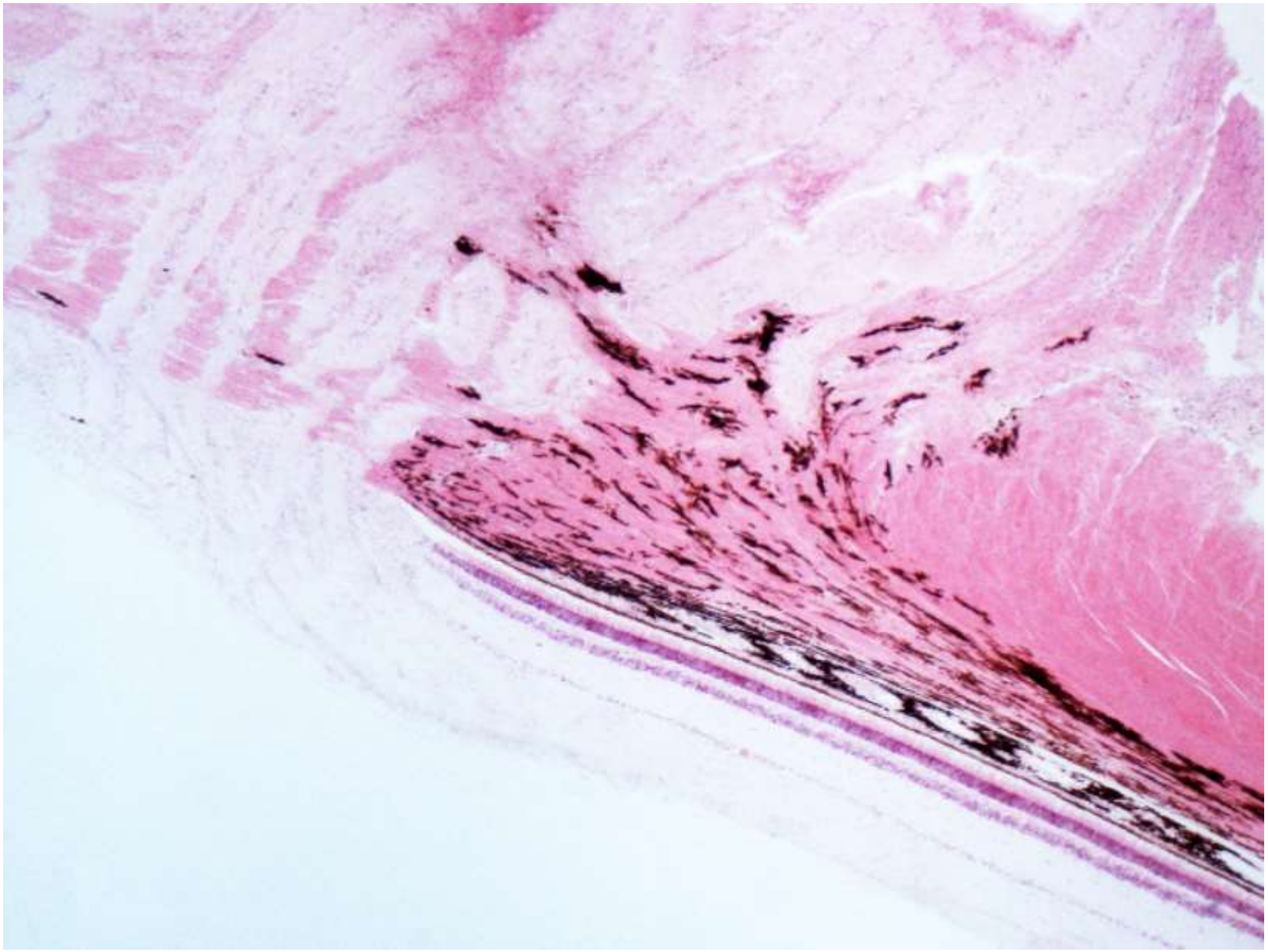
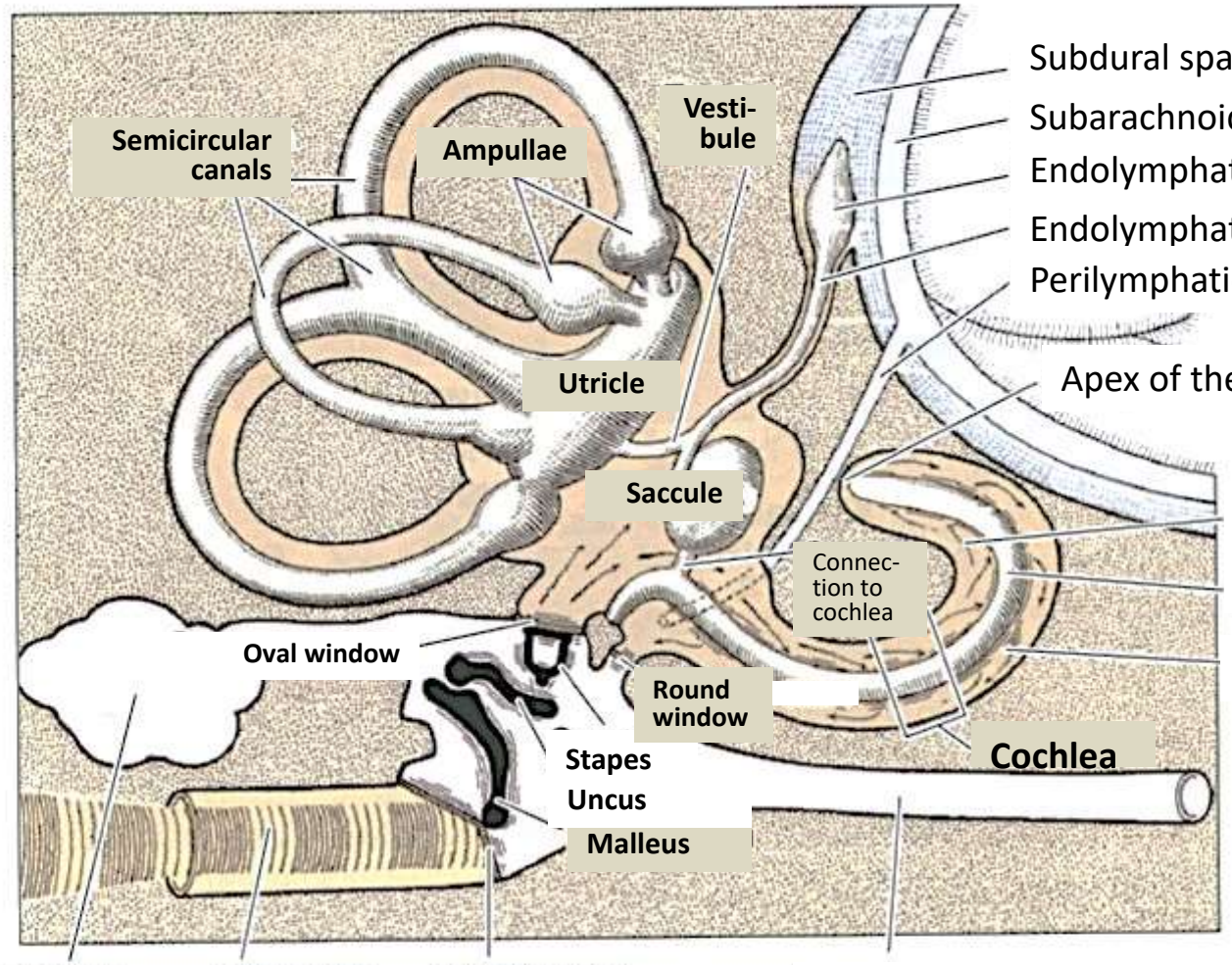


# ORGAN OF HEARING

# *ANATOMY OF THE EAR*



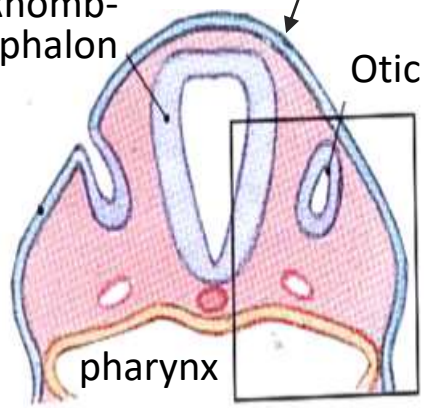
# DEVELOPMENT OF THE EAR

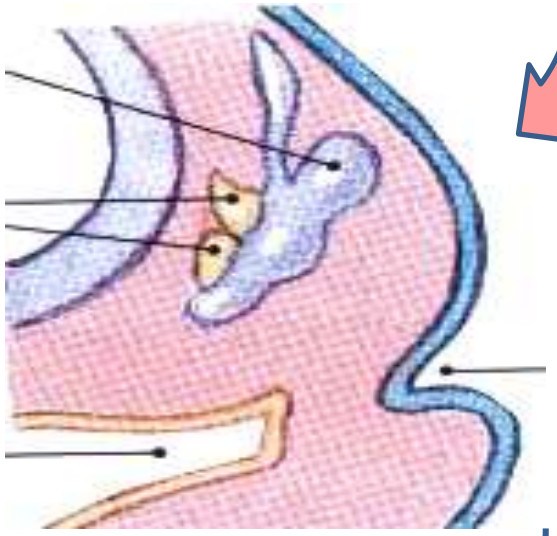
*4th week*

Ectodermal epithelium

Otic placode (a thickening of the epithelium)

Otic vesicle




1st branchial arch

*6th week*

# DEVELOPMENT OF THE EAR

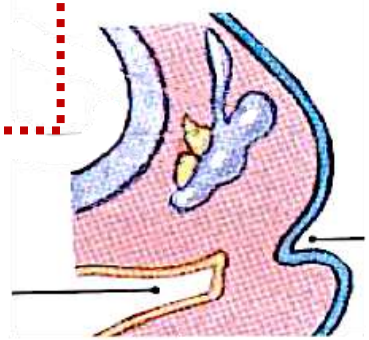
Otic placode

Otic vesicle

Labyrinth of the inner ear

Mesenchyme of the 1st and 2nd branchial arches

Auditory ossicles



External pharyngeal groove

Pharyngeal pouch

Developing ossicles

Cartilage

Vestibular ganglion

Spiral ganglion

Eustachian tube

External auditory canal

Middle ear cavity

External pharyngeal groove

External auditory canal

Outer ear

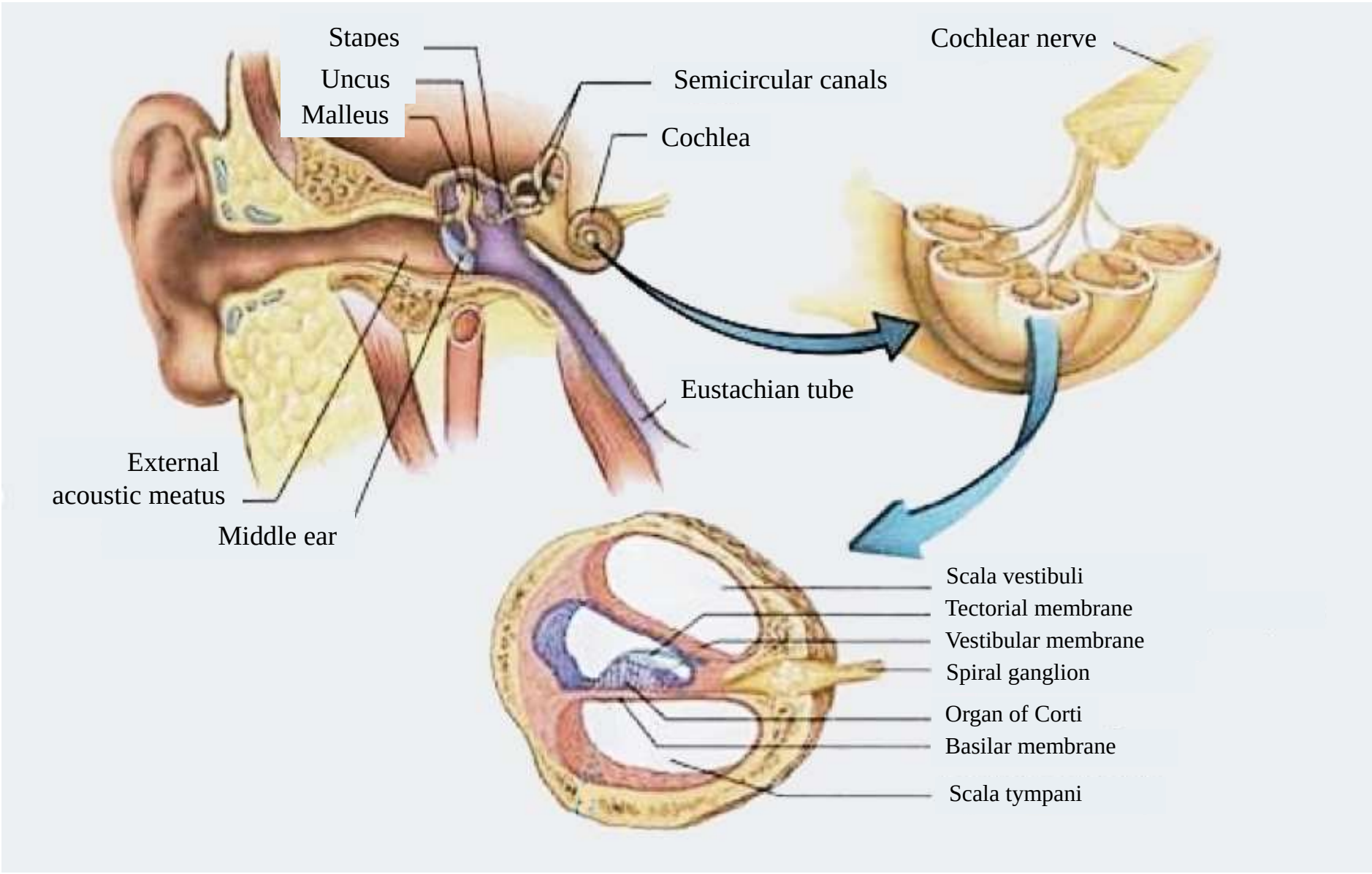
Pharyngeal pouch

Eustachian tube

Middle ear cavity

*7th week*

# *MICROANATOMY OF THE EAR*



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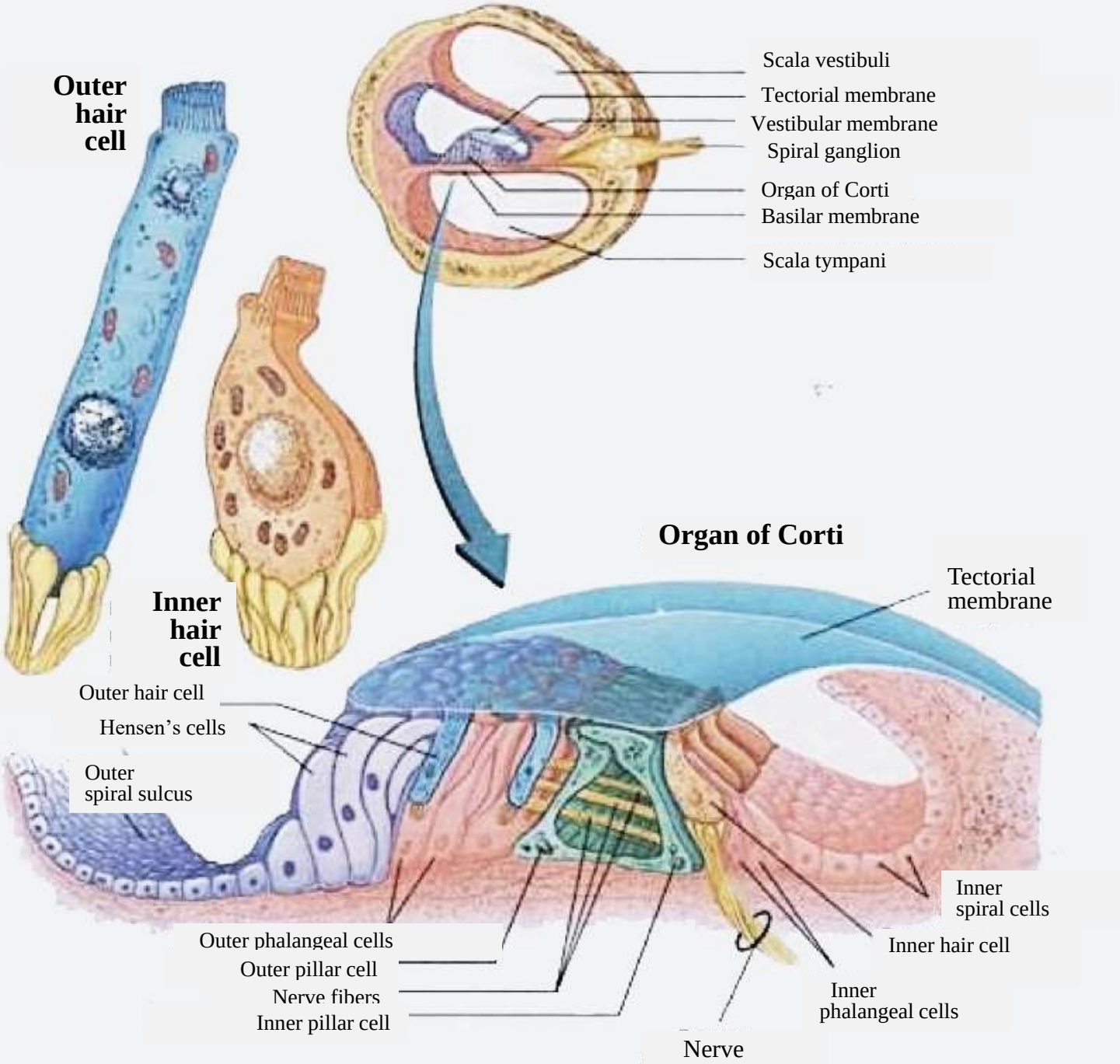
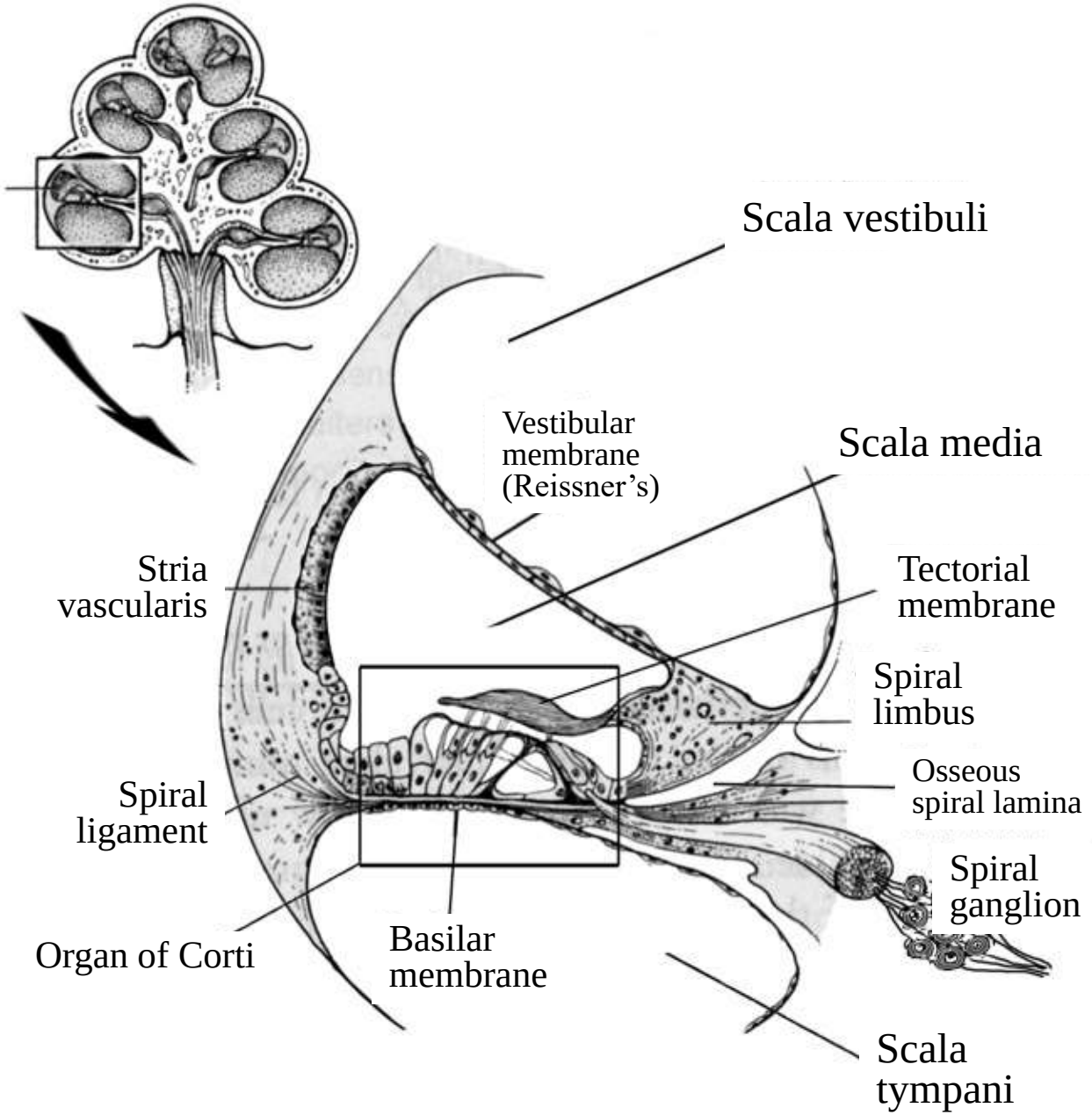
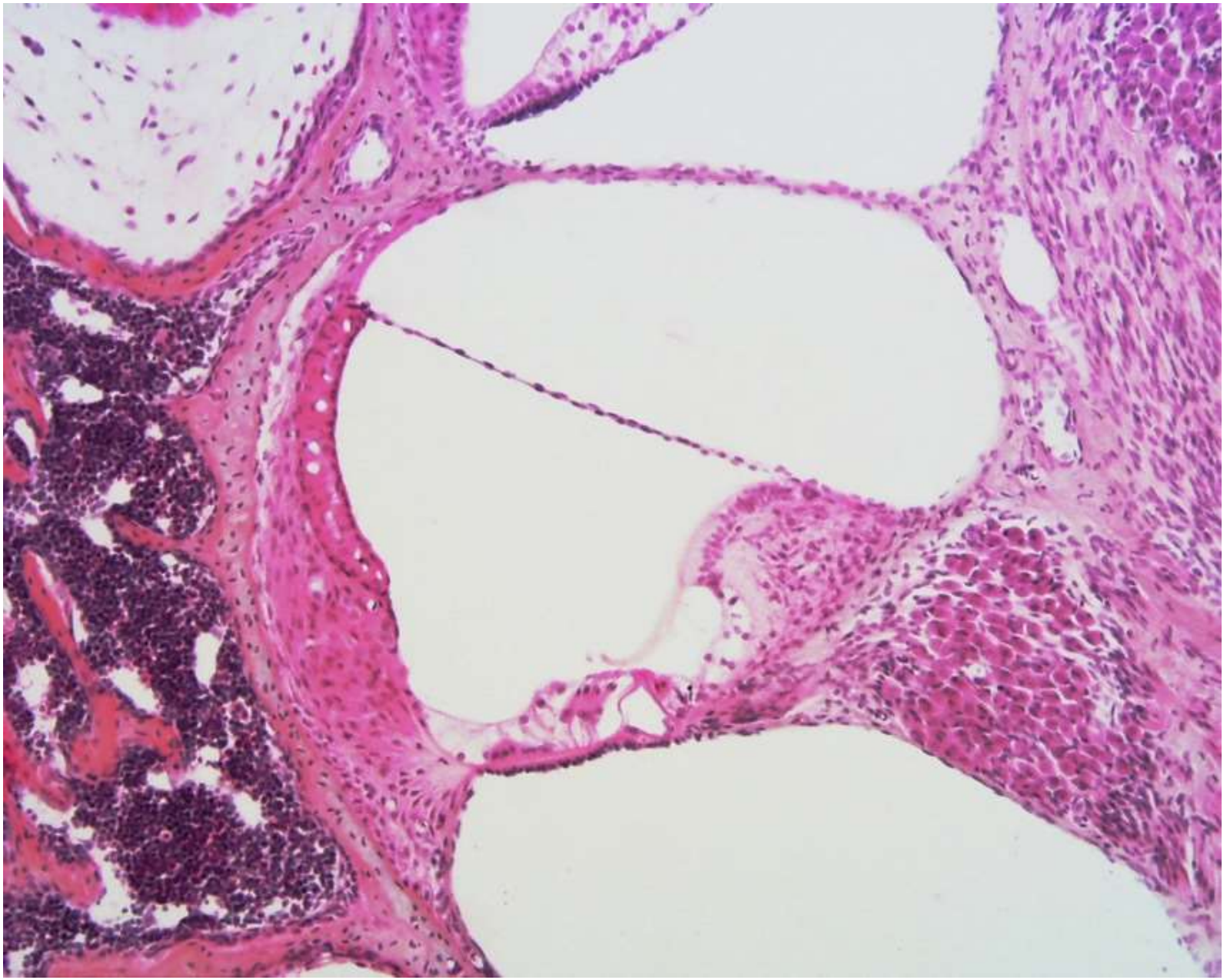
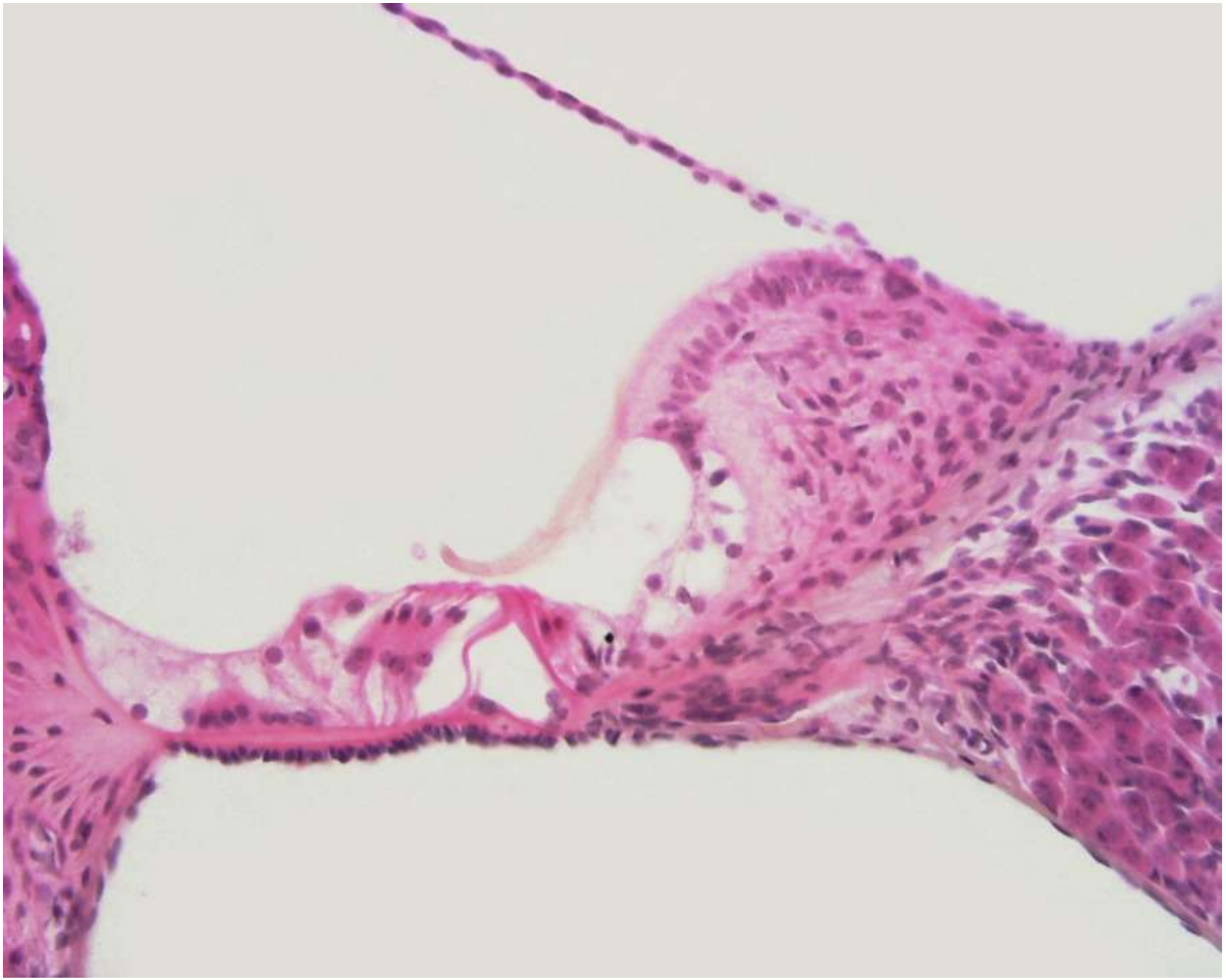


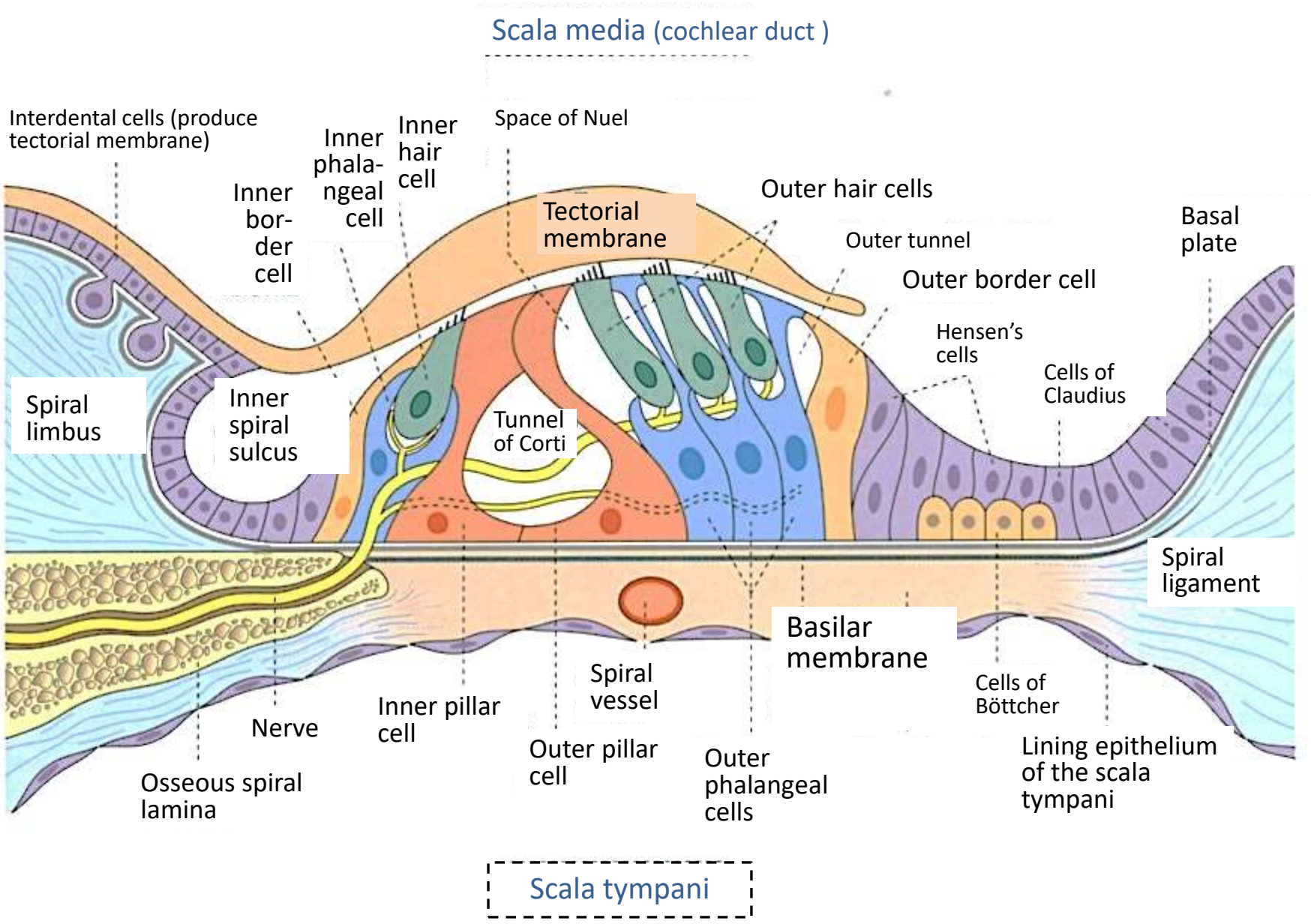
# *MICROANATOMY OF THE COCHLEA*



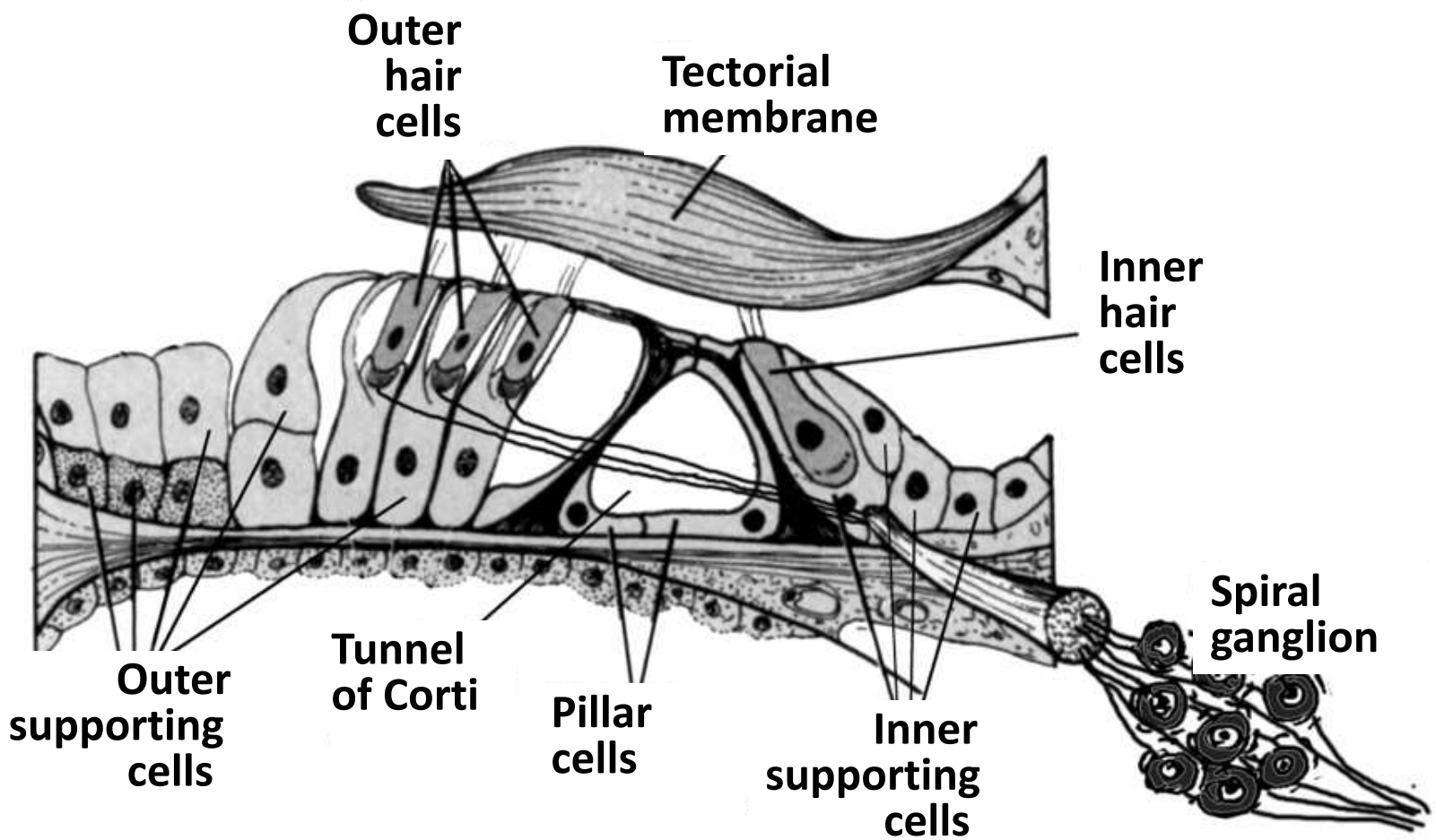




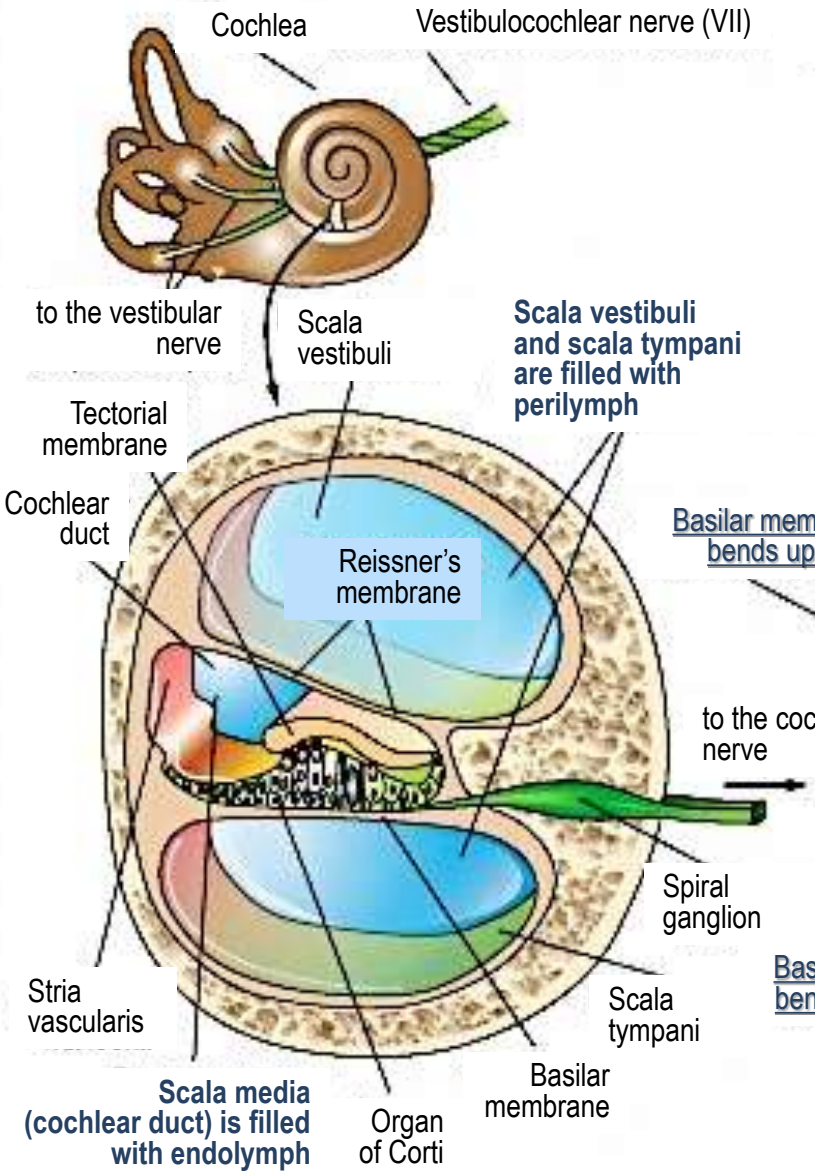
# MICROANATOMY OF THE ORGAN OF CORTI



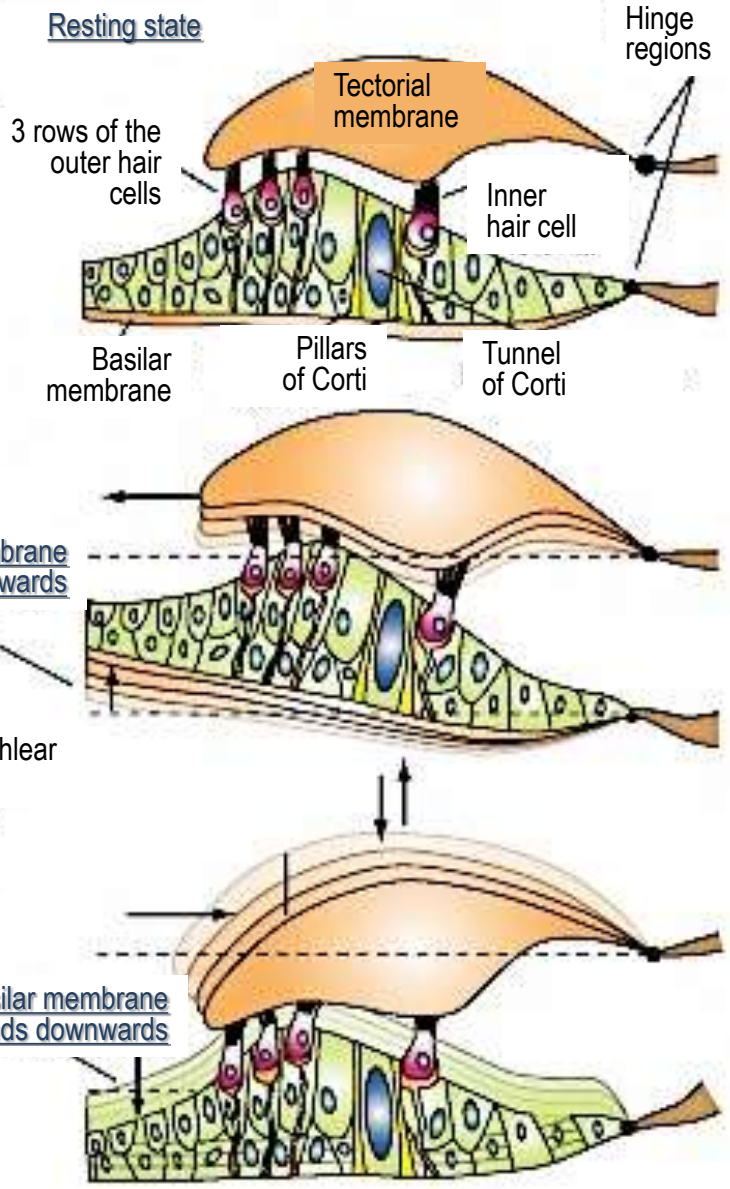
*MICROANATOMY OF THE ORGAN OF CORTI*



## SECTION OF THE COCHLEA

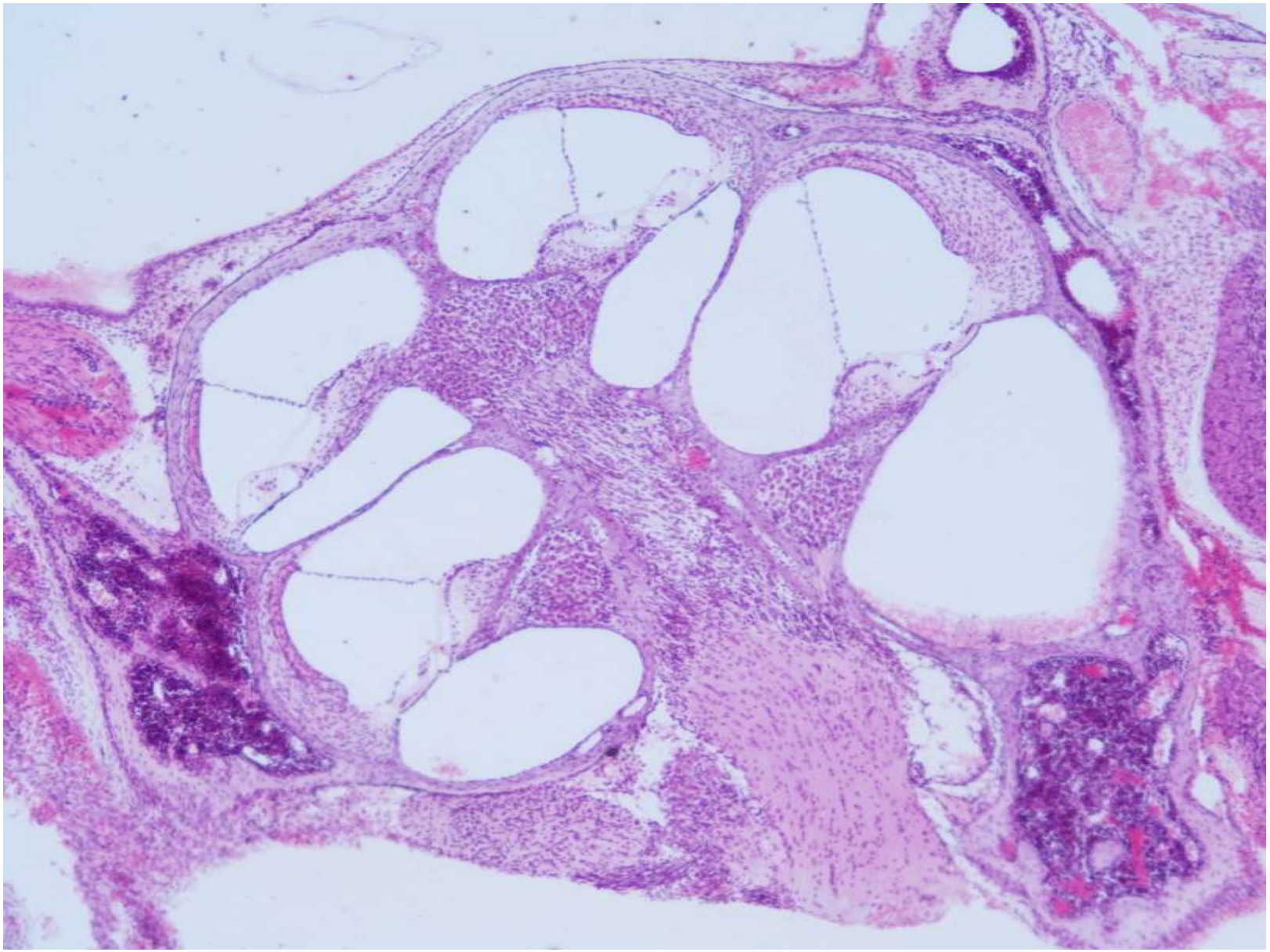



## ORGAN OF CORTI



*Slide №96.* Cochlea of the inner ear, axial section

*Hematoxylin-eosin staining*



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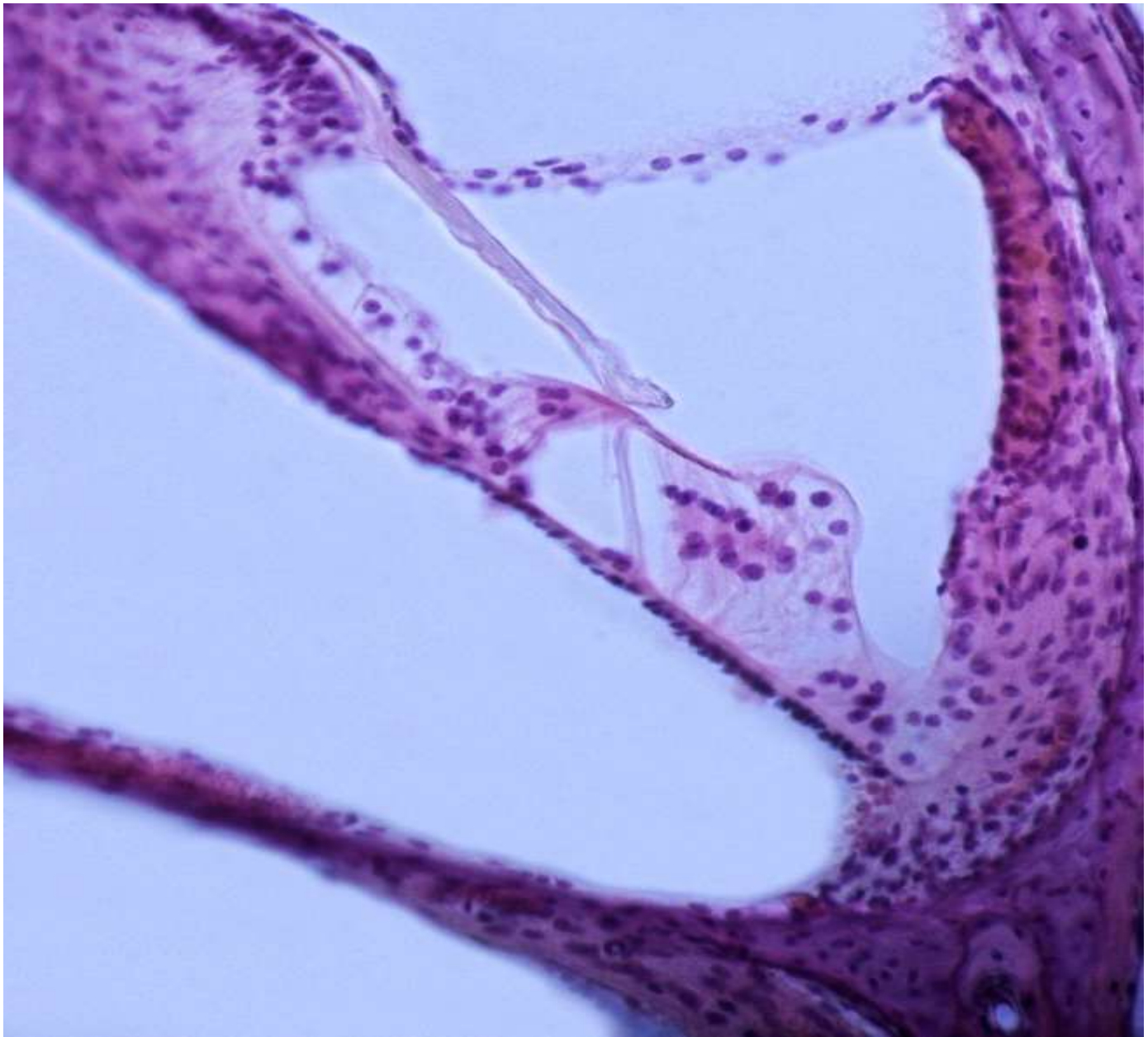

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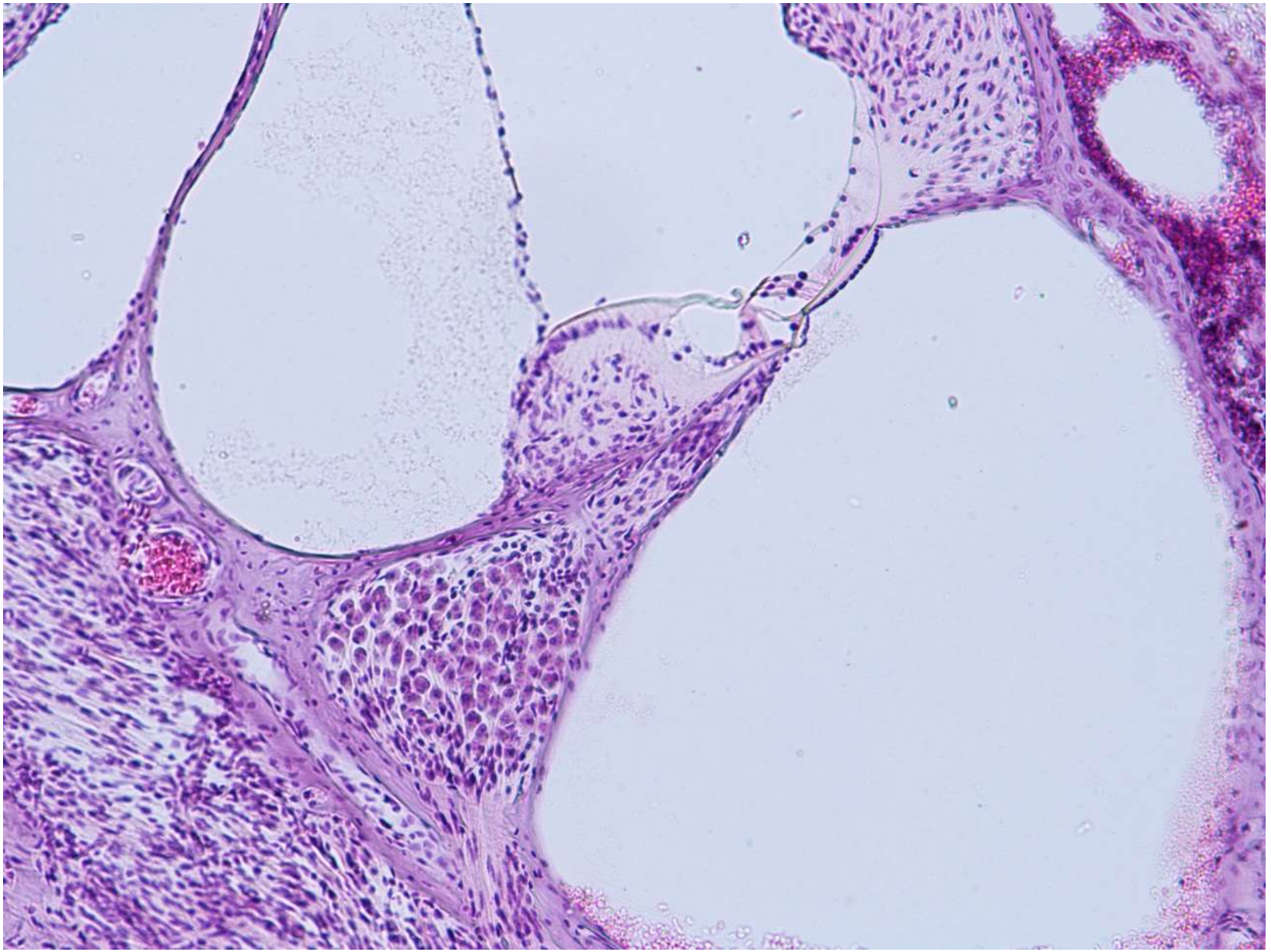

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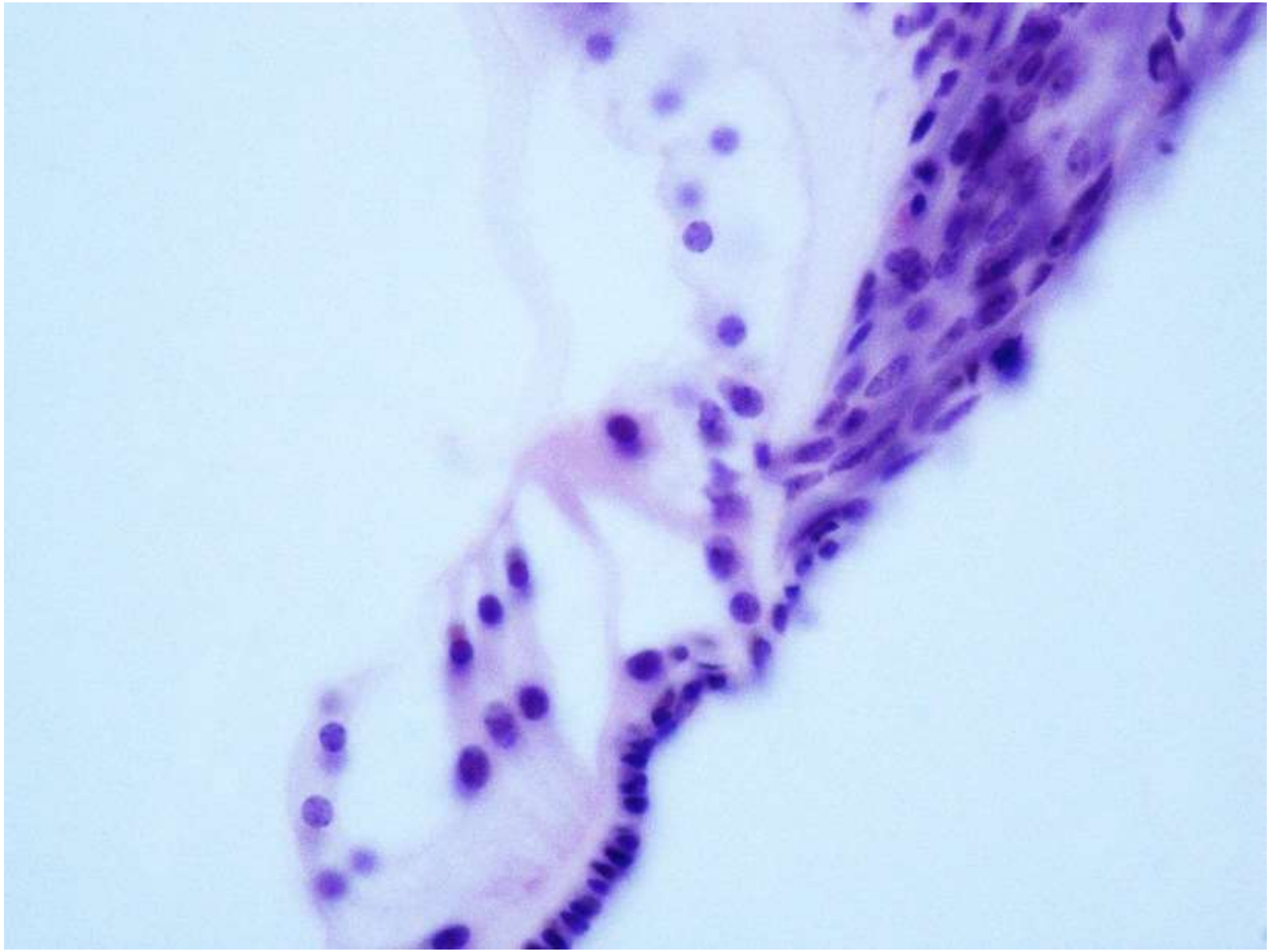


SOUND WAVES

OSCILLATIONS OF THE EARDRUM

OSCILLATIONS OF THE AUDITORY OSSICLES
(malleus, uncus and stapes)

(via the oval window)

OSCILLATIONS OF THE PERILYMPH IN SCALA VESTIBULI

(via the apex of the cochlea)

(via the Reissner's membrane)

OSCILLATIONS OF THE ENDOLYMPH

OSCILLATIONS OF THE PERILYMPH IN SCALA TYMPANI

OSCILLATIONS OF THE SECONDARY TYMPANIC MEMBRANE (in the round window)

OSCILLATIONS OF THE TECTORIAL MEMBRANE

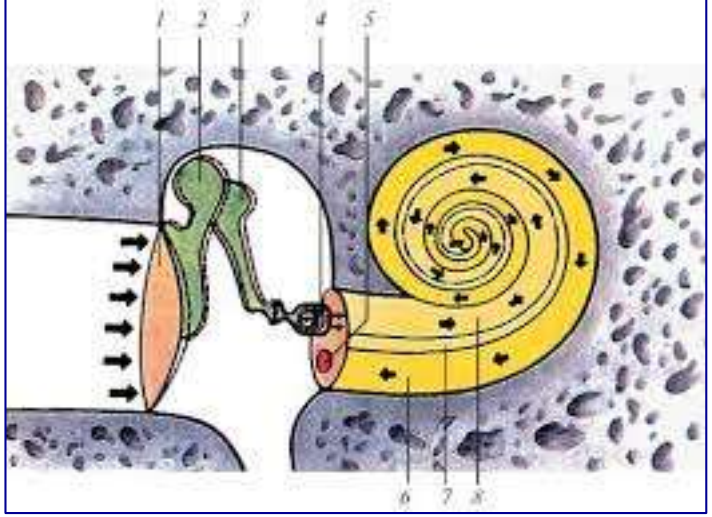
OSCILLATIONS OF THE BASILAR MEMBRANE OVERLAID BY THE ORGAN OF CORTI

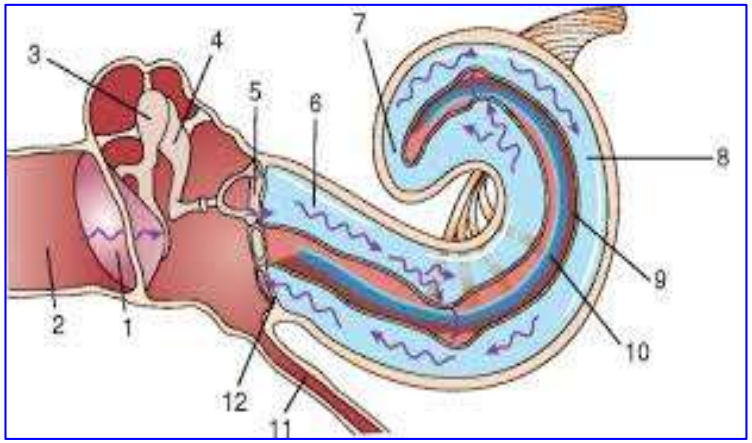
SHIFT OF THE TECTORIAL MEMBRANE
RELATIVE TO THE ORGAN OF CORTI
CAUSES THE BENDING OF STEREOCILIA

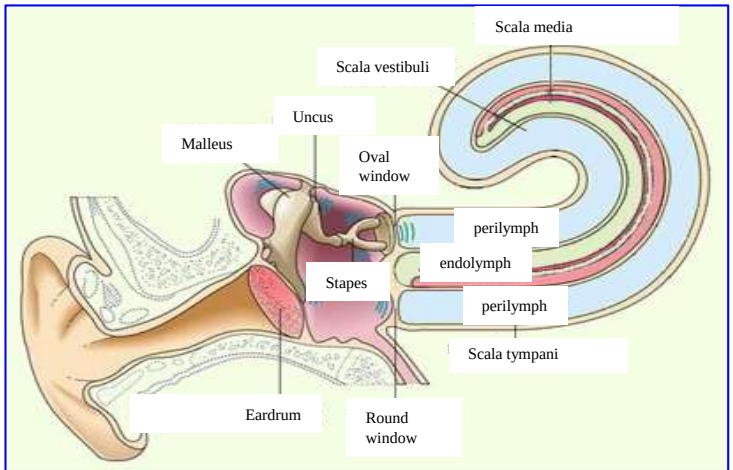
EXCITATION OR INHIBITION OF THE HAIR CELLS

THE EXCITATION IS TRANSMITTED
TO THE DENDRITES
OF THE SPIRAL GANGLION SENSORY NEURONS

THE NEURONS SEND IMPULSES TO THE CEREBRUM



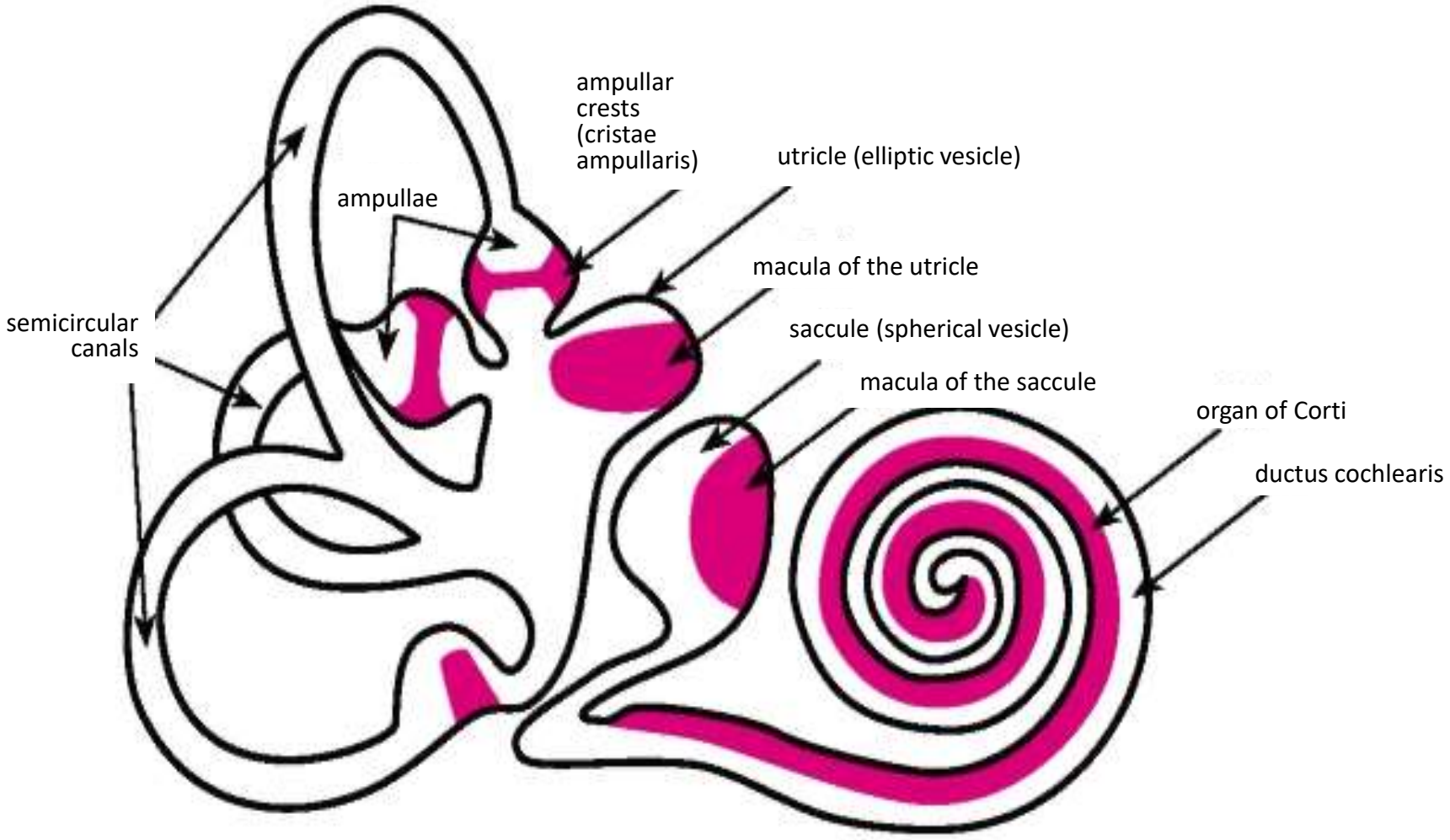



# ORGAN OF BALANCE

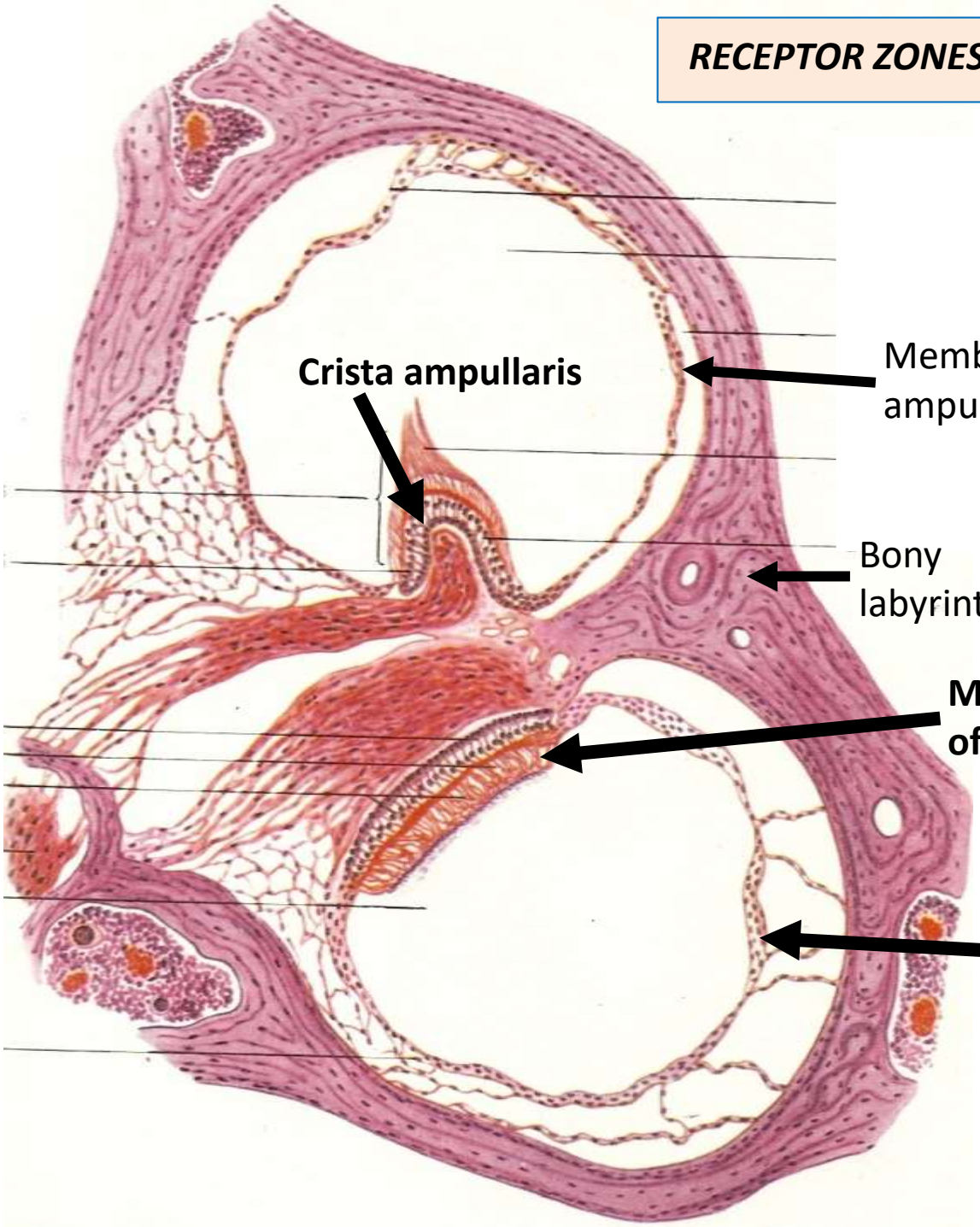
# *THE INNER EAR. ORGAN OF BALANCE. RECEPTOR ZONES OF THE MEMBRANOUS LABYRINTH*

Maculae of the utricle and saccule provide sensations of gravity and linear acceleration

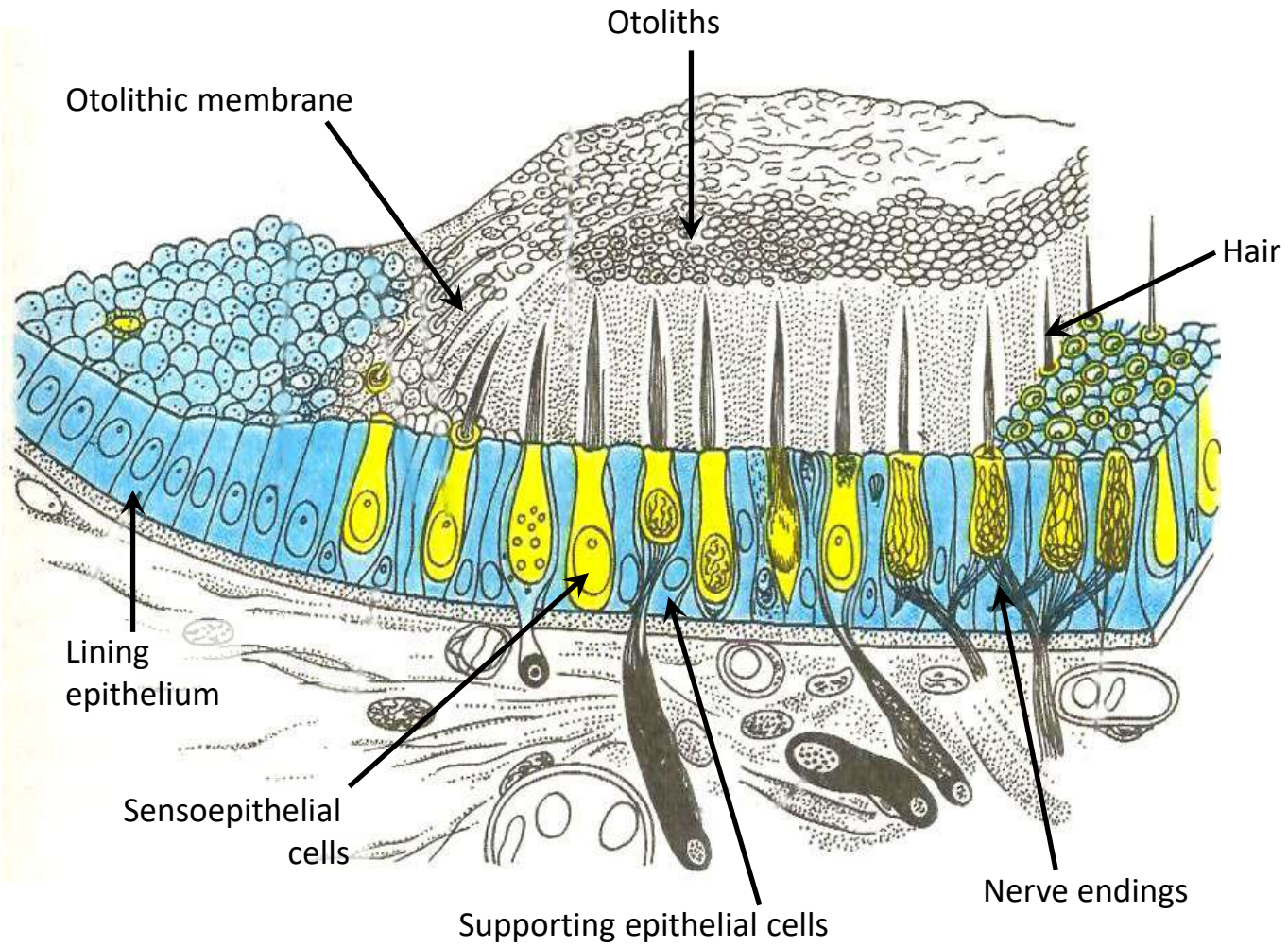
Cristae ampullaris of the semicircular canals provide the sense of rotation



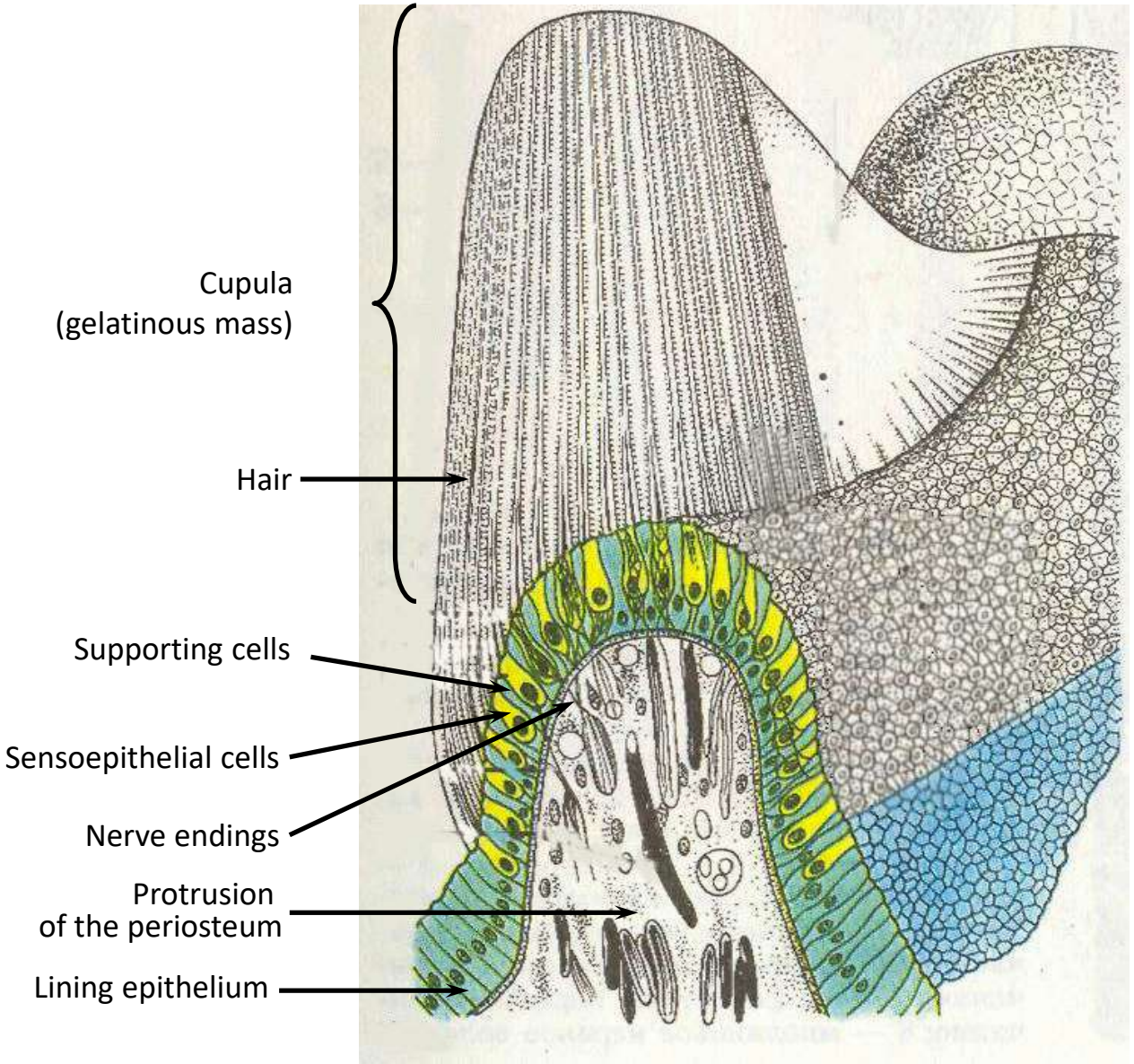
# *RECEPTOR ZONES OF THE ORGAN OF BALANCE*

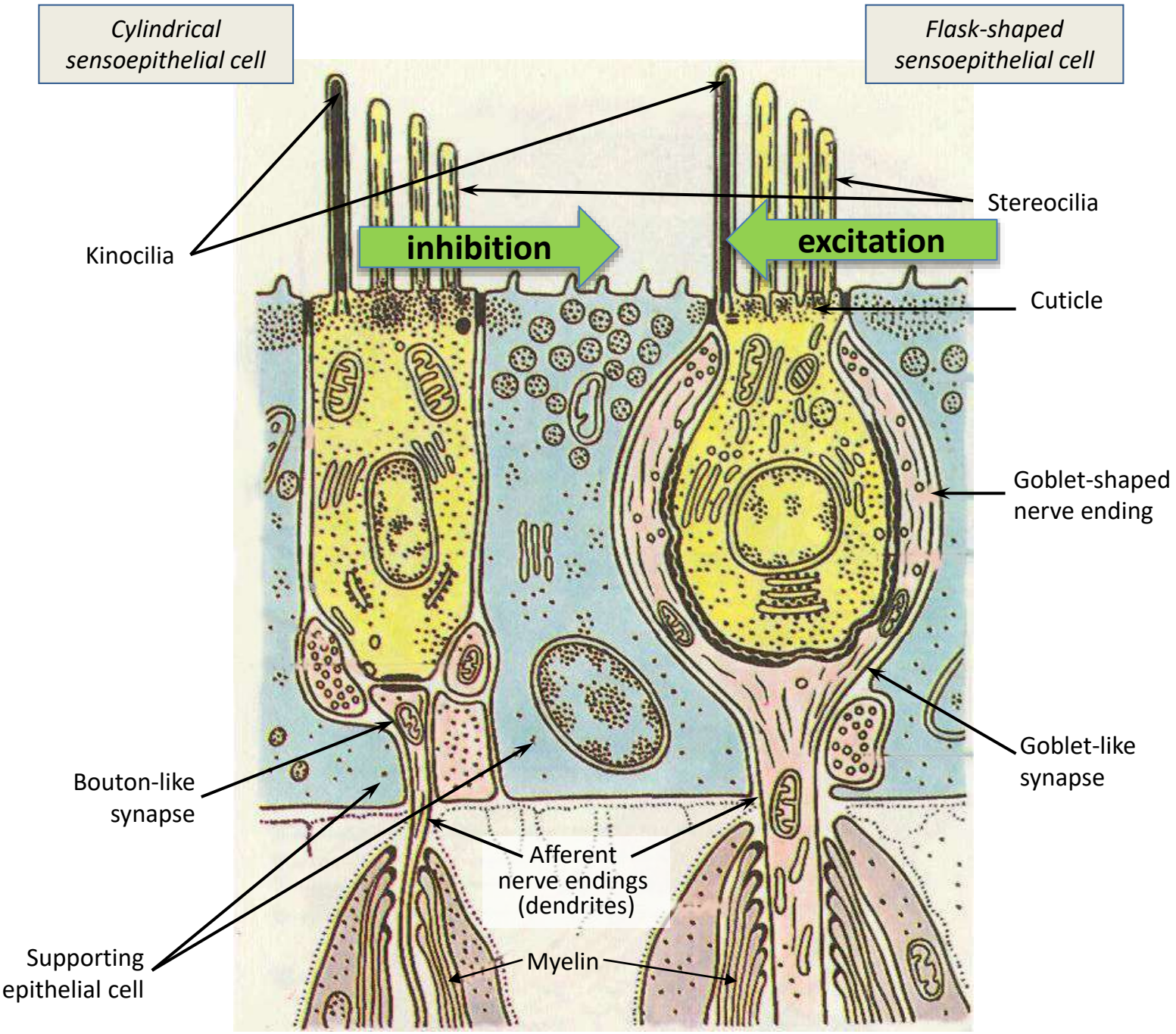


# MACULA


Otoliths
Otolithic membrane
Hair
Lining epithelium
Sensoepithelial cells
Supporting epithelial cells
Nerve endings

# *CRISTA AMPULLARIS*




Cylindrical sensoepithelial cell
Flask-shaped sensoepithelial cell
Kinocilia
Stereocilia
inhibition
excitation
Cuticle
Goblet-shaped nerve ending
Goblet-like synapse
Bouton-like synapse
Afferent nerve endings (dendrites)
Supporting epithelial cell
Myelin

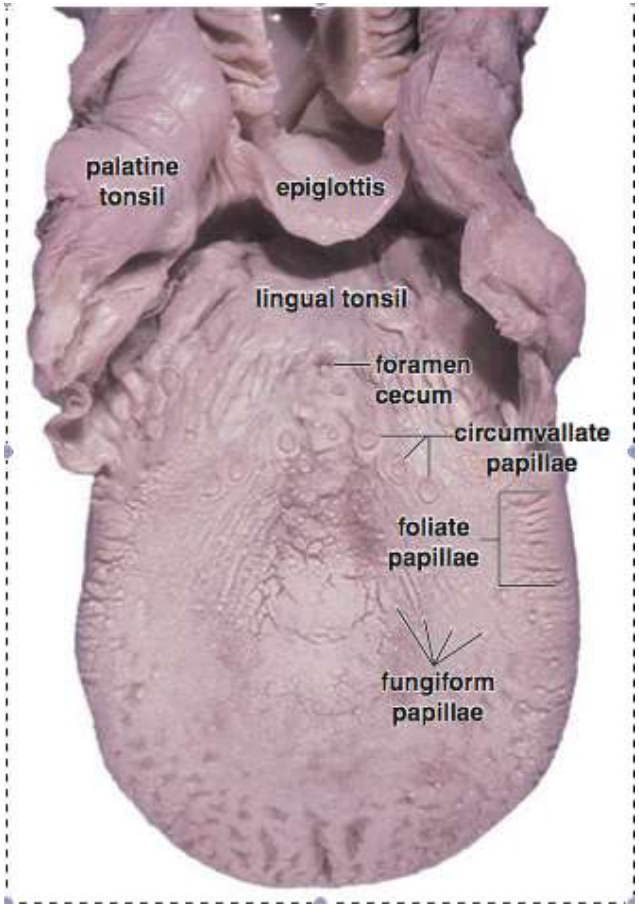
# ORGAN OF TASTE

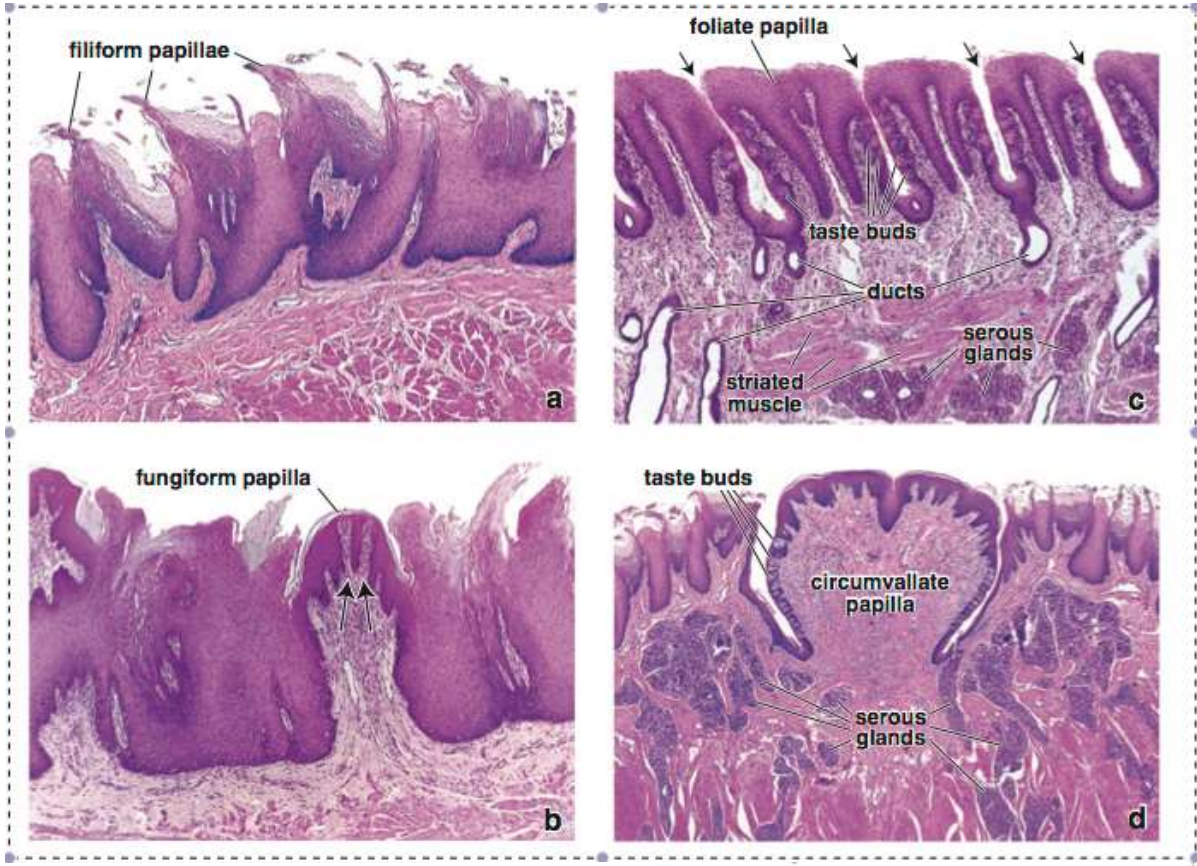
# *EMBRYONIC DEVELOPMENT OF THE TASTE BUDS*

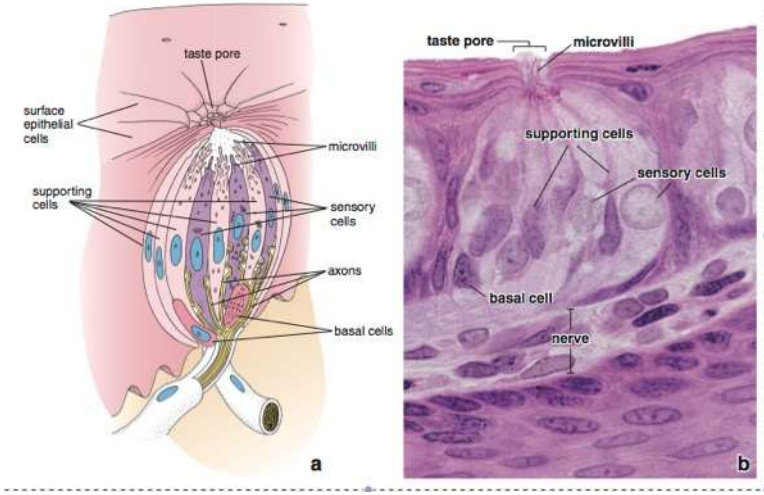
***Source of the development is*:**

**basal layer of the stratified epithelium covering the lingual papillae**

# LINGUAL PAPILLAE



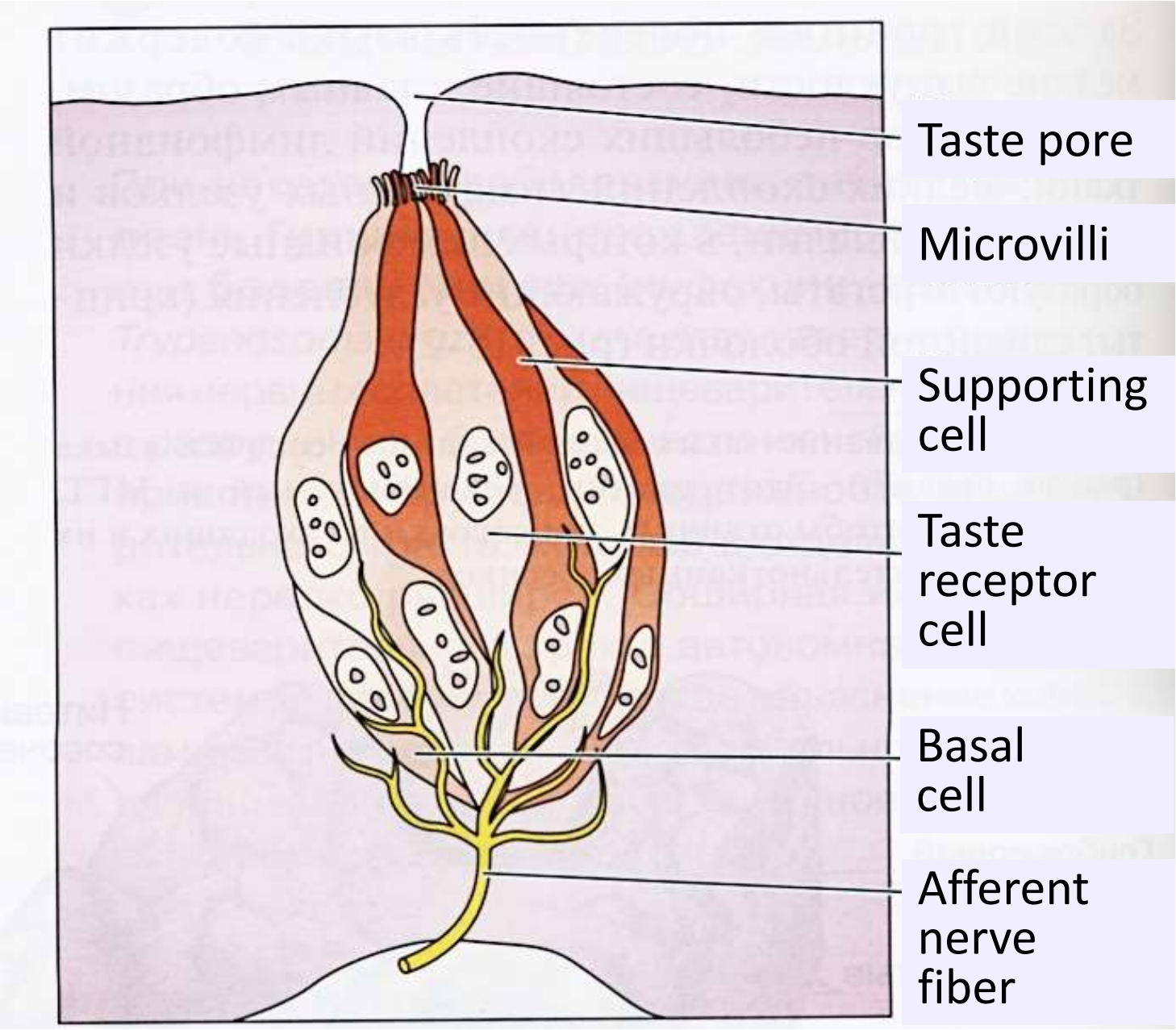




Taste buds are absent in filiform papillae

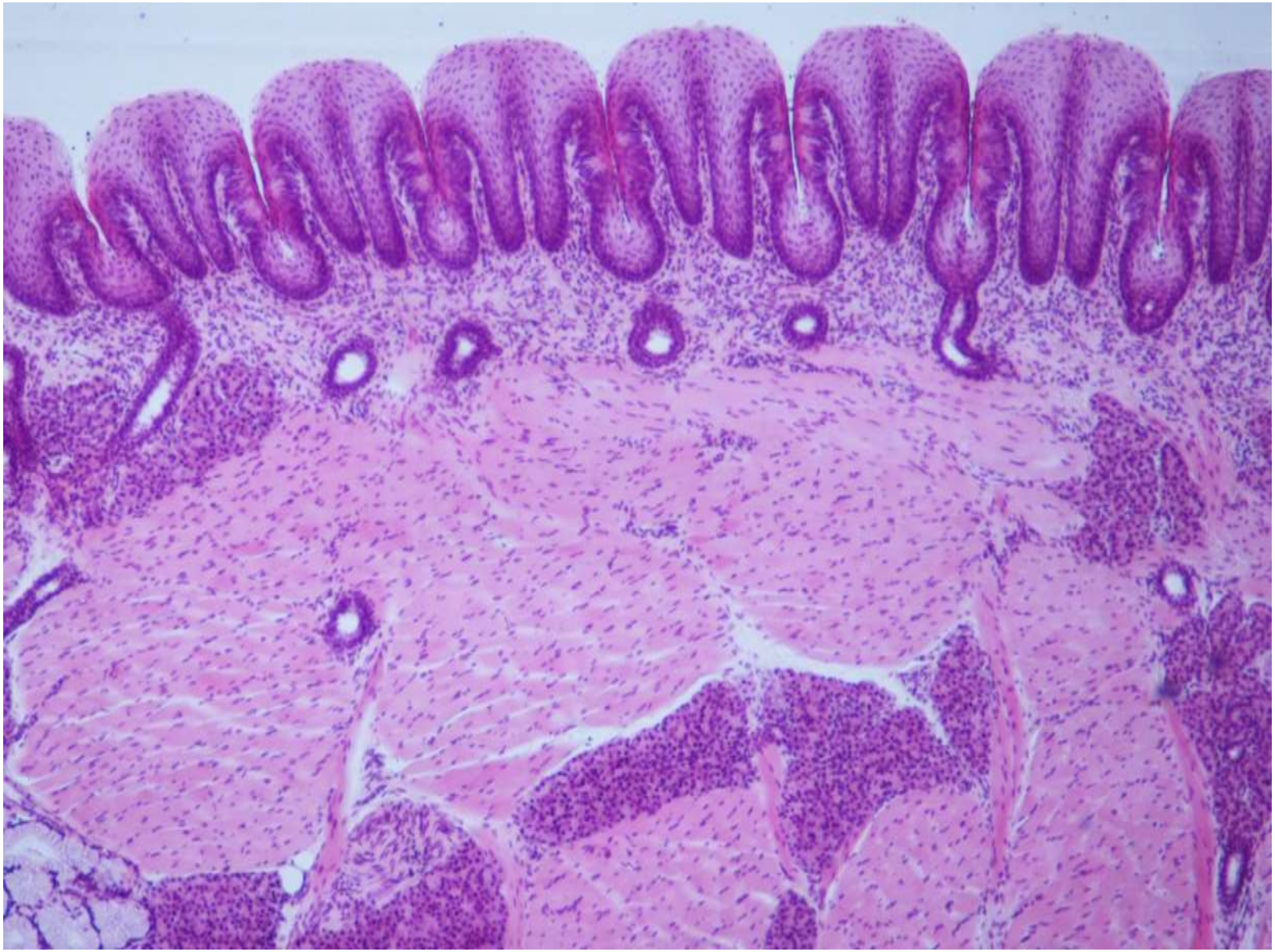
# TASTE BUD

# MICROANATOMY OF THE TASTE BUD



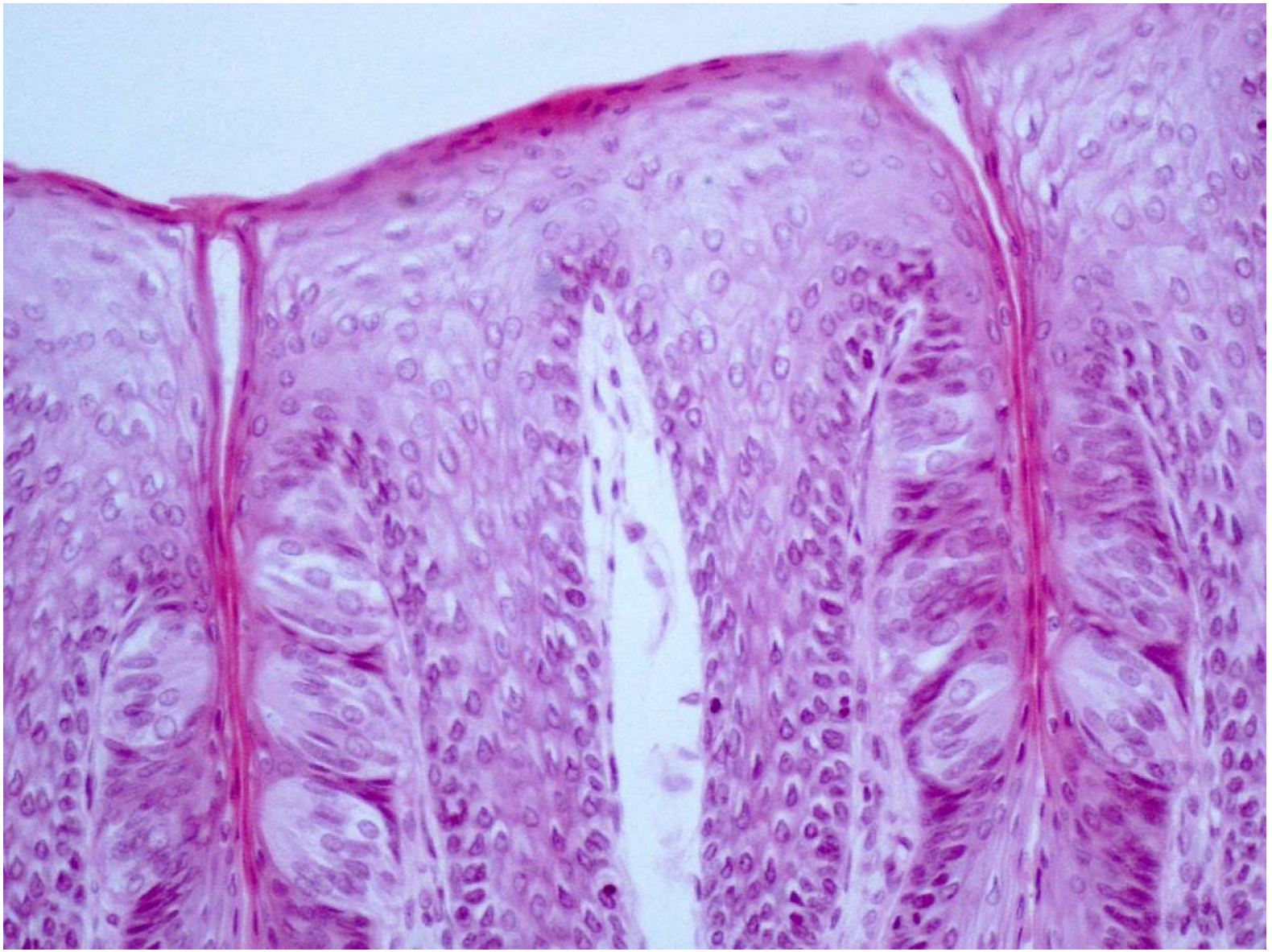
*Slide №98.* Taste buds of the foliate papilae. Section of the tongue

*Hematoxylin-eosin staining*



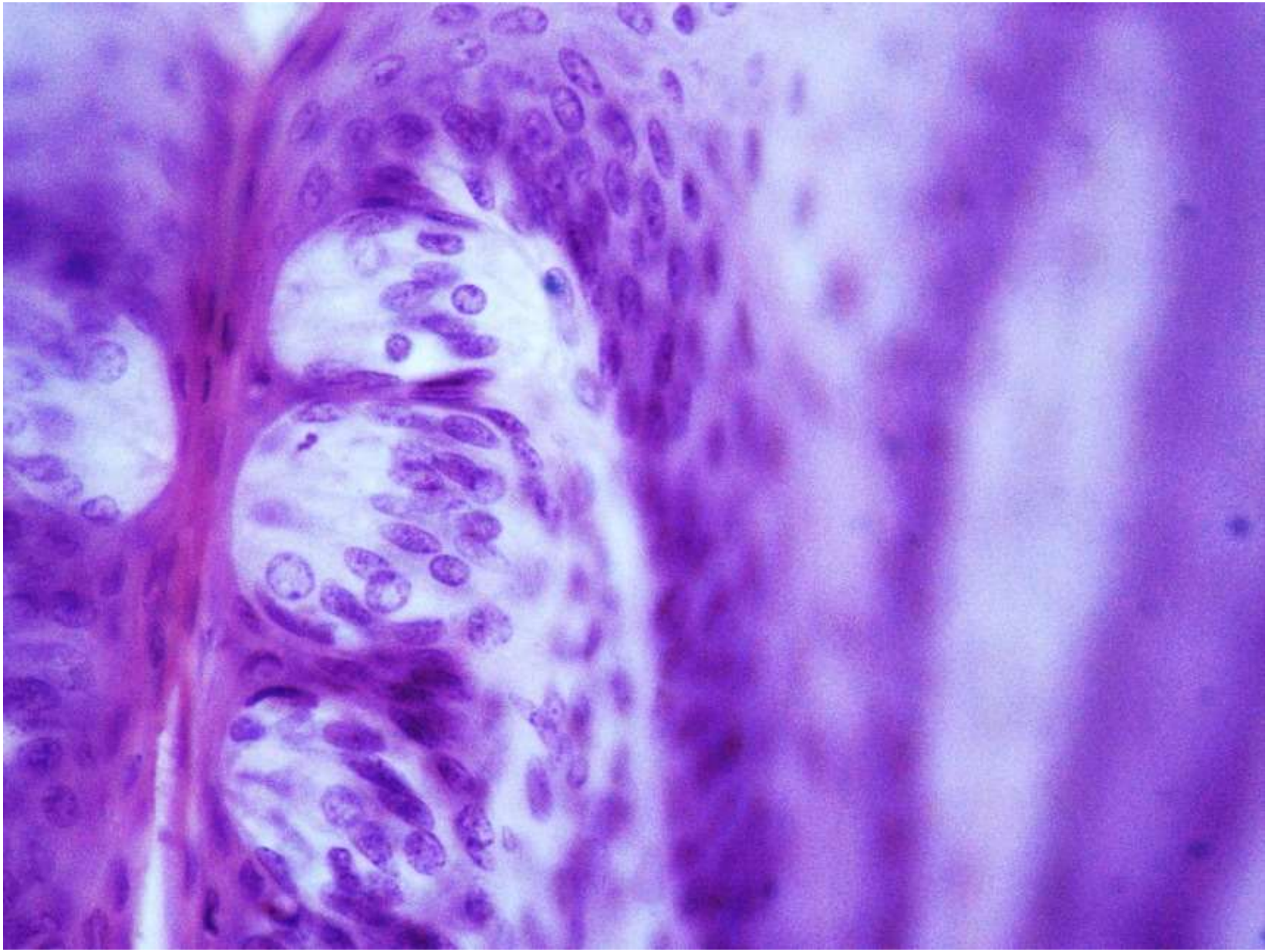
*Slide №98.* Taste buds of the foliate papilae. Section of the tongue

*Hematoxylin-eosin staining*



*Slide №98.* Taste buds of the foliate papilae. Section of the tongue

*Hematoxylin-eosin staining*



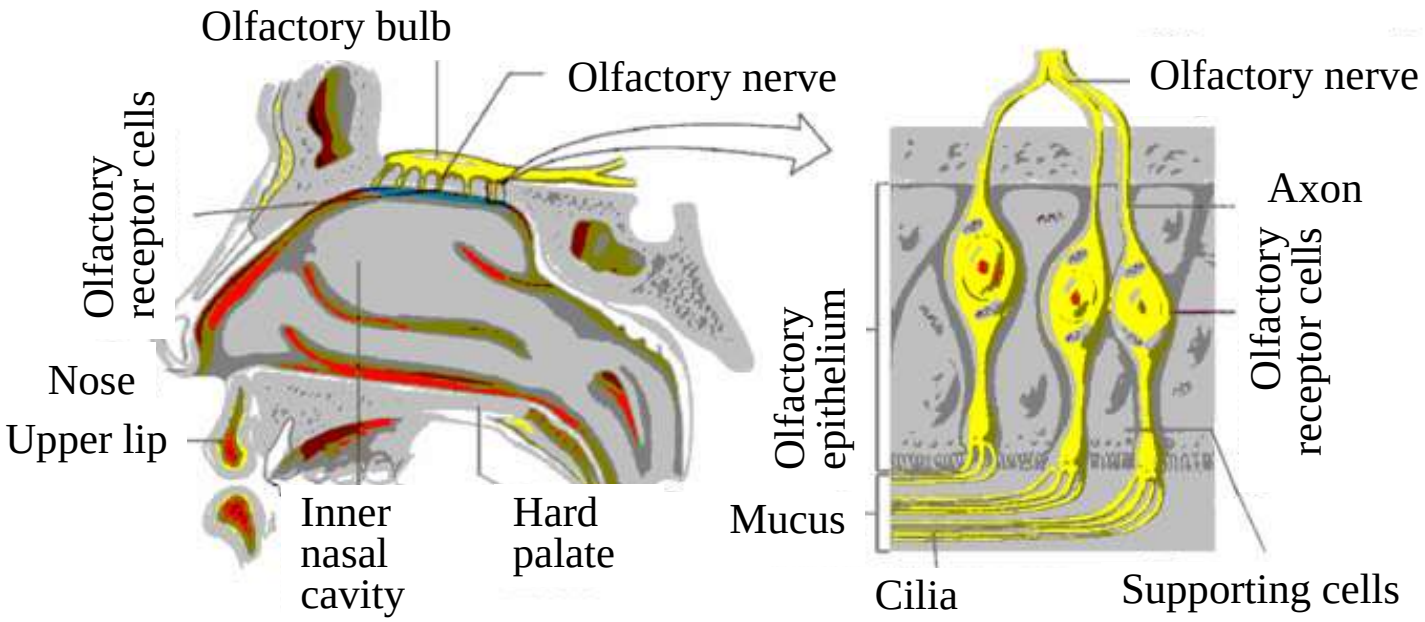
# ORGAN OF OLFACTION

# DEVELOPMENT OF THE OLFACTORY ORGAN

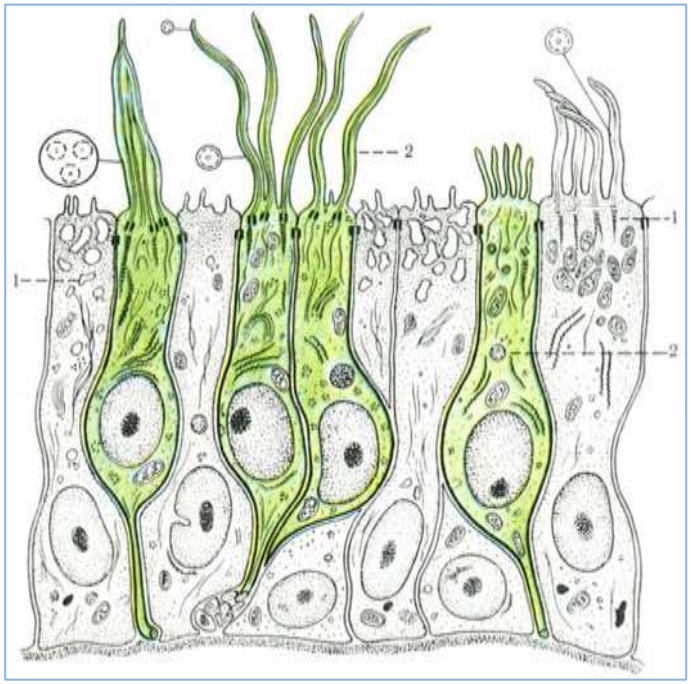
3rd month
Olfactory placodes form
as epithelial thickenings
of the head surface ectoderm

4th month
Placodes are converted into olfactory pits

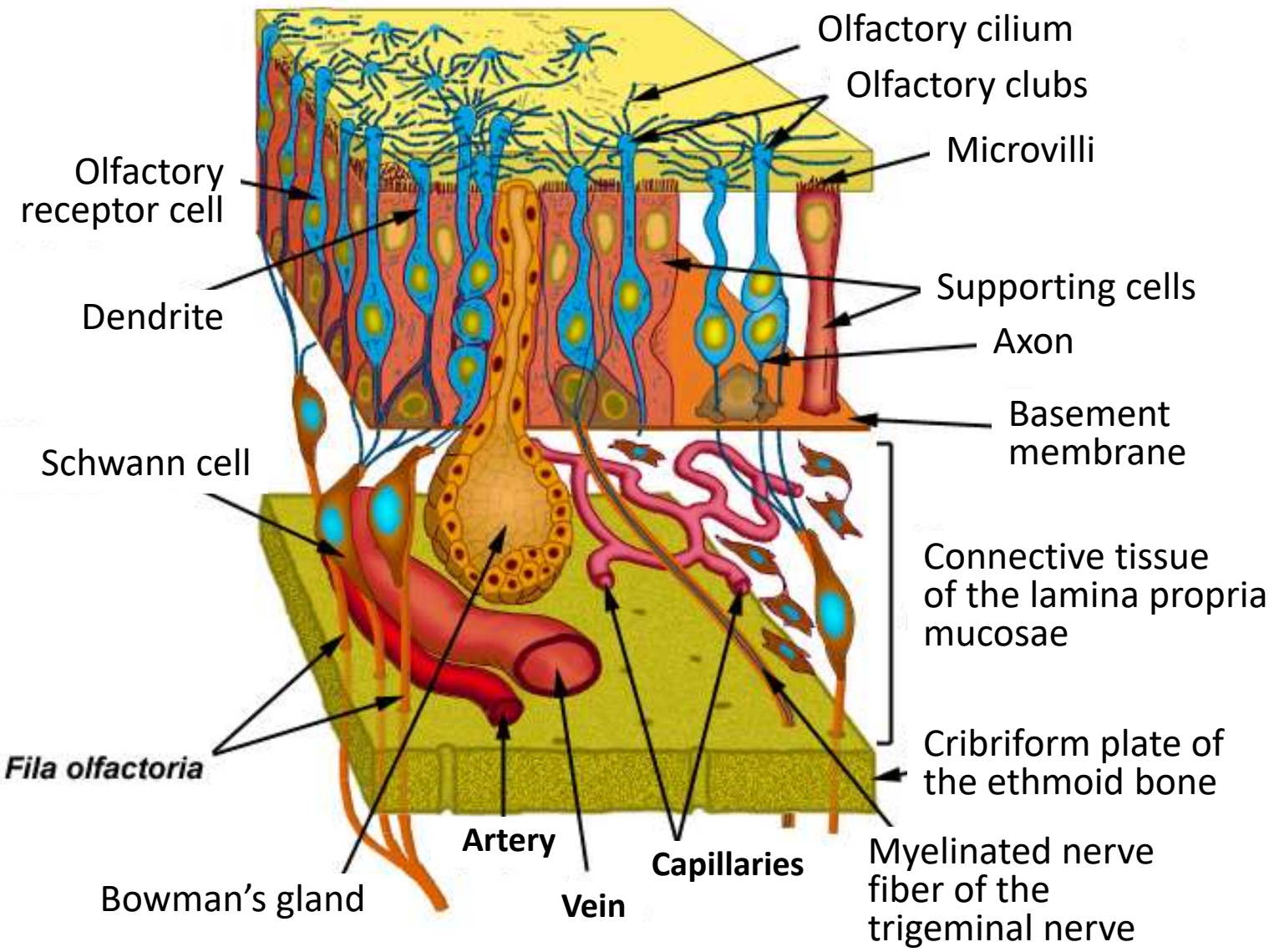
Differentiation
of supporting epithelial cells
and olfactory neurosensory cells



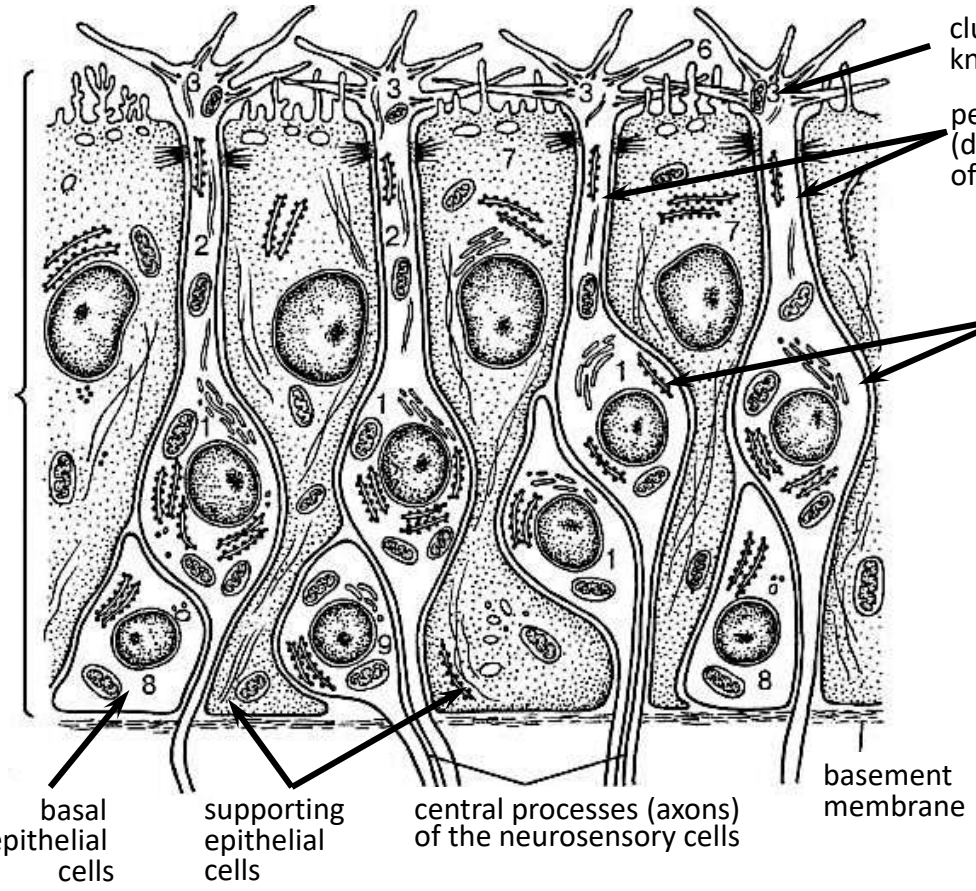

## MICROANATOMY OF THE OLFACTORY EPITHELIUM

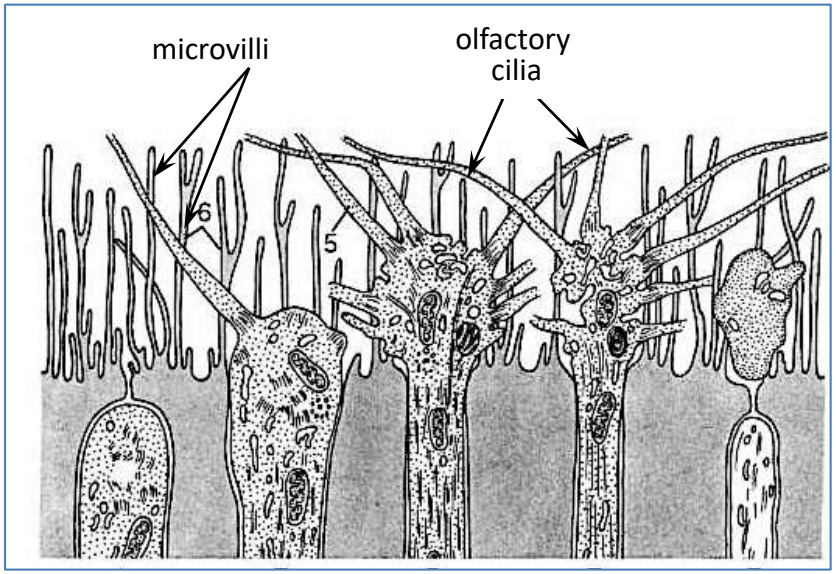


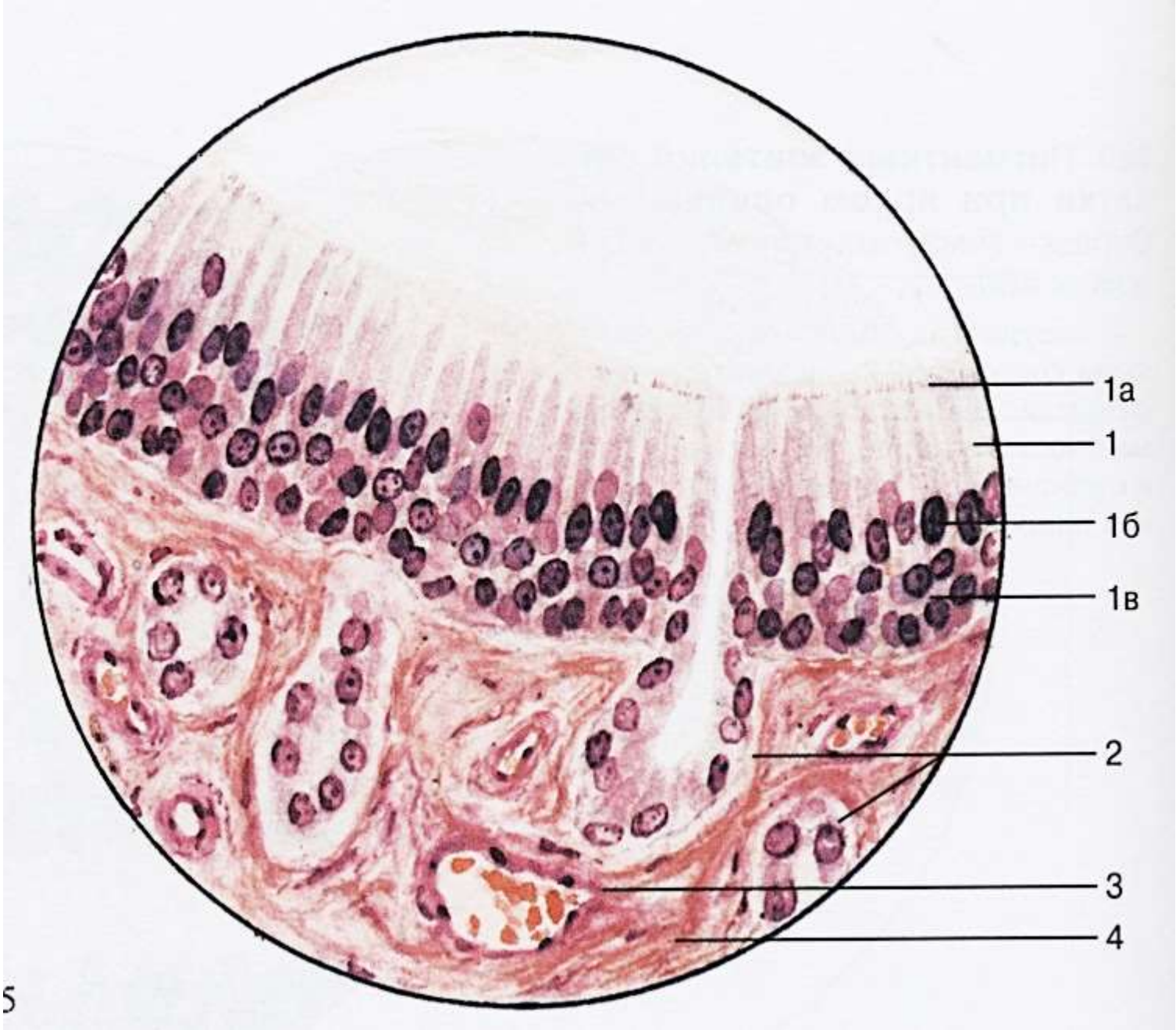
# MICROANATOMY OF THE OLFACTORY EPITHELIUM



# MICROANATOMY OF THE OLFACTORY EPITHELIUM



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