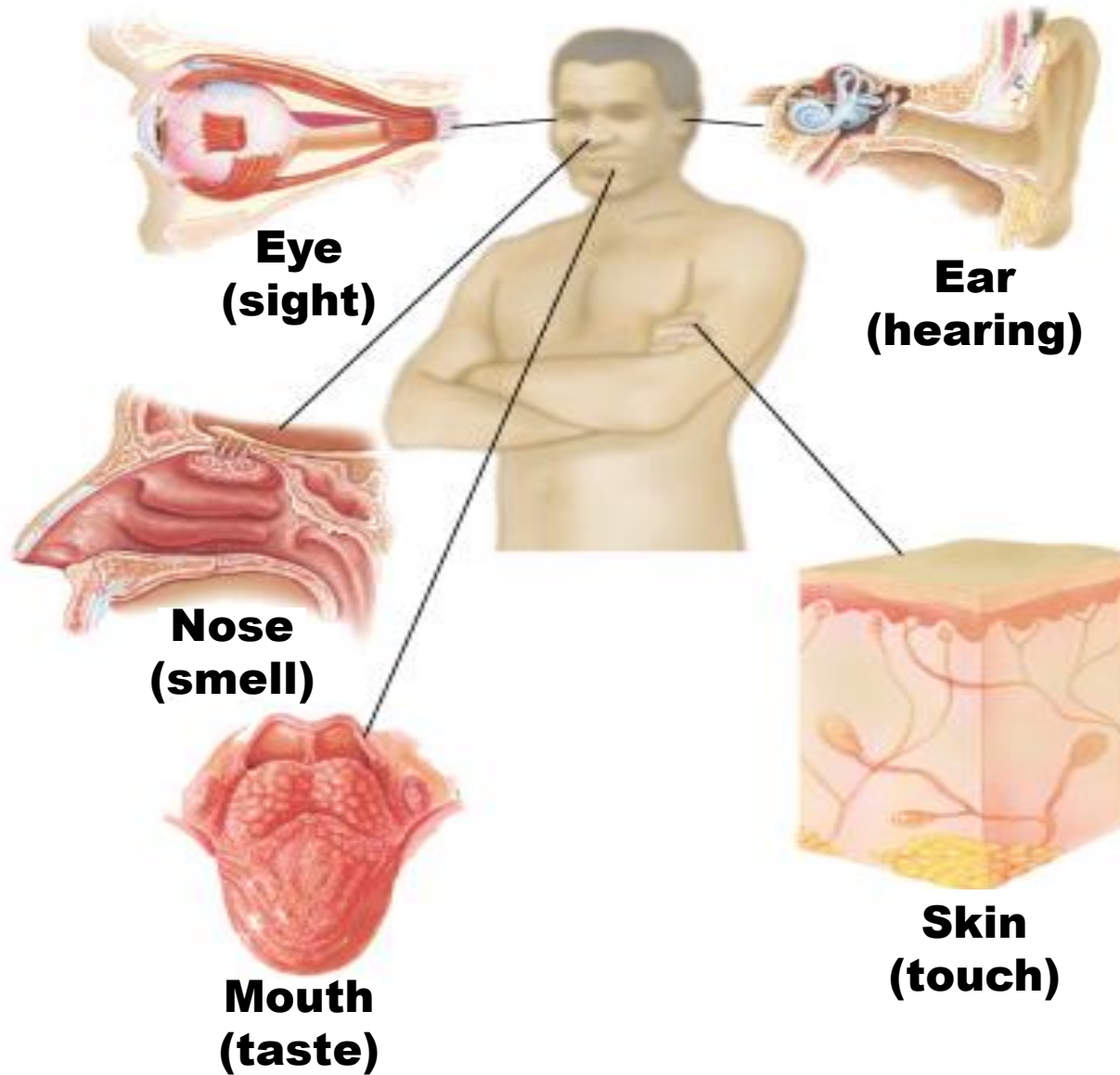


# The Sensory System



# Objectives

**After studying this chapter, you will be able to:**

- **Name the parts of the sensory system and discuss the function of each part**
- **Define combining forms used in building words that relate to the sensory system**
- **Identify the meaning of related abbreviations**
- **Name the common diagnoses, clinical procedures, and laboratory tests used in treating disorders of the sensory system**

# Objectives cont'd

- **List and define the major pathological conditions of the sensory system**
- **Explain the meaning of surgical terms related to the sensory system**
- **Recognize common pharmacological agents used in treating disorders of the sensory system**

# Structure and Function

**The sensory system includes any organ or part involved in the perceiving and receiving of stimuli.**

**sight**

**Five Senses**

**taste**

**smell**

**hearing**

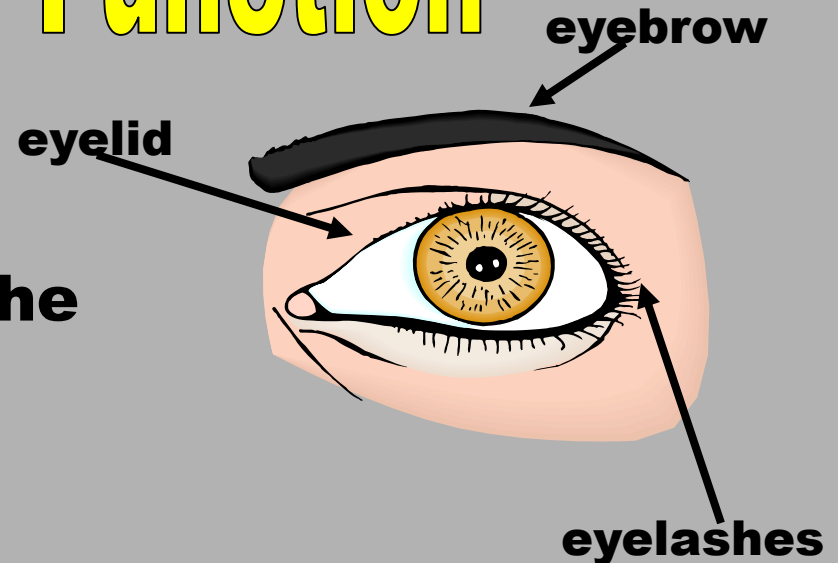
**touch**

**All sensory organs contain specialized **receptor** cells that receive stimuli.**

# Structure and Function

## Sight-the Eye

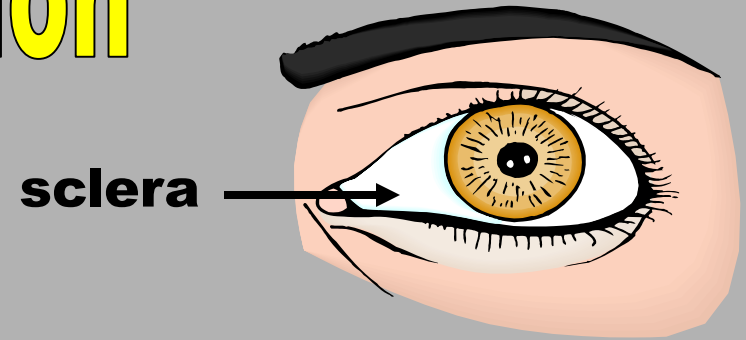
- **Contains about 70% of all the receptors in the body**
- **Each eye is a sphere consisting of three layers:**
  - **outer layer (eyelid)**
  - **middle layer (vascular layer)**
  - **interior layer (retinal layer)**



**Note: Eyebrows and eyelashes keep foreign particles from entering the eye.**

# Structure and Function

## The Eye (cont'd)



- The anterior surface of the eye and posterior surface of the eyelid are lined with a mucous membrane called the **conjunctiva**
- The **sclera** is the white posterior section of the eye that supports the eyeball
- The **cornea** is transparent, lacks blood vessels and bends or **refracts** light rays as they enter the eye

# Structure and Function

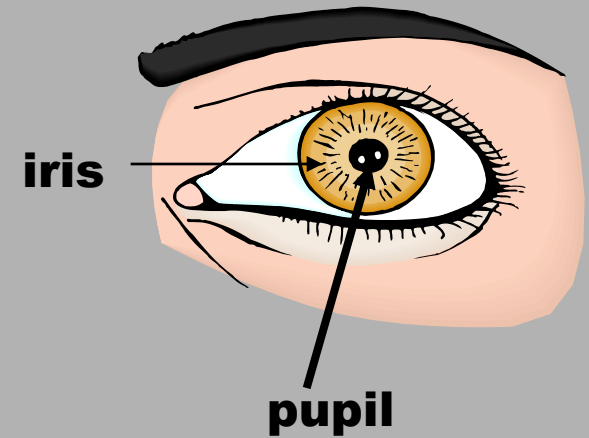
## The Middle Layer

- The vascular layer of blood vessels which consists of a thin posterior membrane called the **choroid**
- The **Ciliary Body** is anterior and contains the ciliary muscles used for focusing the eye
- The ciliary body contracts to change the shape of the lens in a process called **accommodation**

# Structure and Function

## Other Eye Structures

- **Pupil** (black circular center of the eye)
- **Lens** (colorless, transparent body behind the iris)
- **Iris** (colored part of the eye)
- **Retina** (light sensitive membrane that decodes the light waves and sends information to the brain)





# Structure and Function

## The Retinal Layer

- Interior layer of the eye
- Contains a light sensitive membrane called the retina which consists of several layers

## Layers of the Retina

### Neuroretina

- Thick layer of nervous tissue consisting of specialized nerve receptor cells called **rods** and **cones**

### Optic Disk

- Region where the retina connects to the **optic nerve**

### Macula lutea

- Small yellowish area in the center of the retina directly behind the lens which has a depression in the center called the **fovea centralis**

# Structure and Function

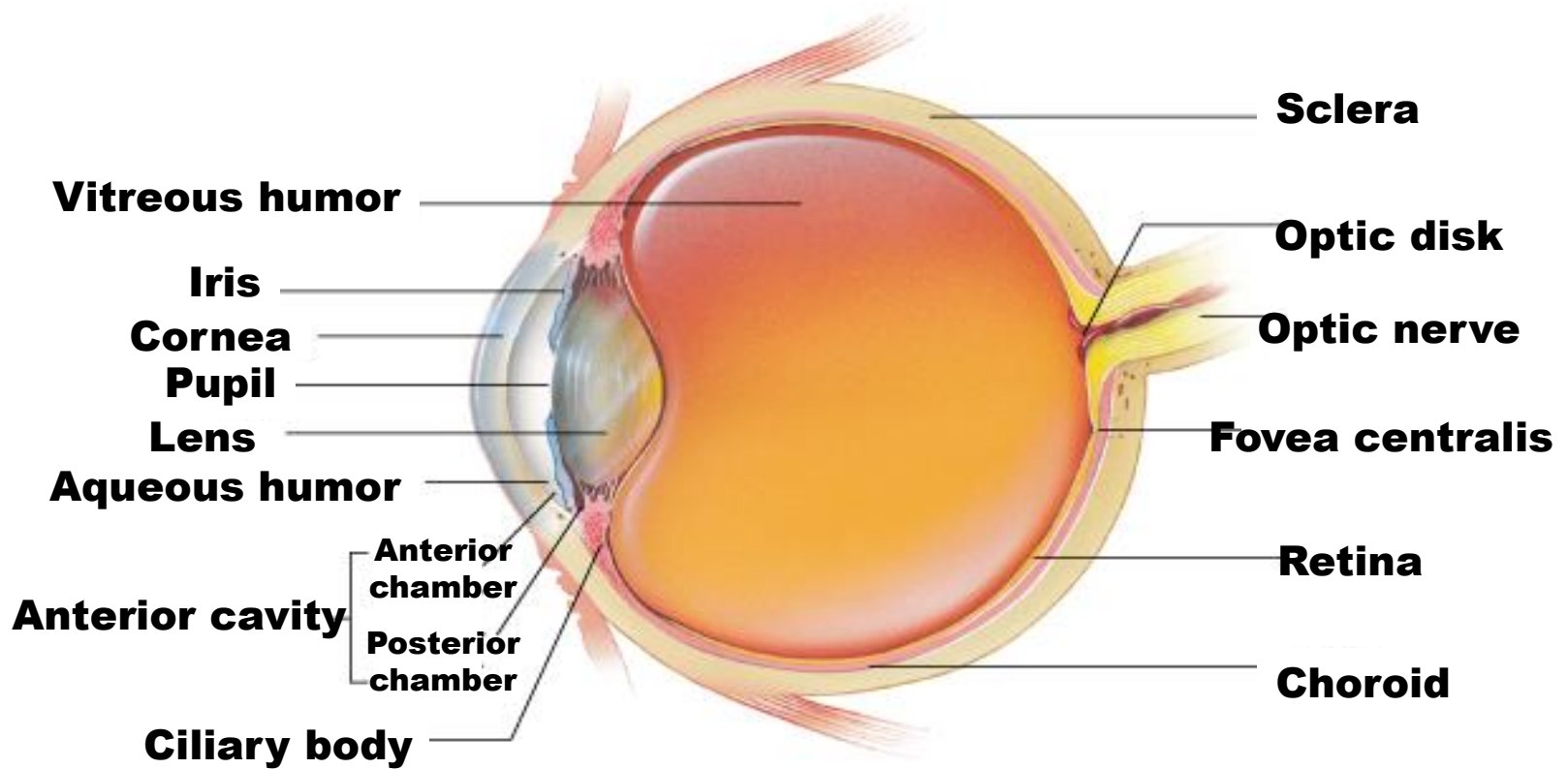
## The Eyeball

- **Is divided into three cavities called chambers:**
  - **Anterior chamber (between the cornea and iris)**
  - **Posterior chamber (between the iris and lens)**
  - **Vitreous chamber (posterior to the lens and is the largest chamber)**

**Both the anterior and posterior chambers are filled with a thin watery liquid called the aqueous humor. Vitreous humor is a gelatinous substance that supports the eye.**

**Note: lacrimal glands secrete moisture into the tear ducts**

# Structure and Function



# Structure and Function

## Hearing and Equilibrium – the Ear

The ear is an organ of hearing and equilibrium

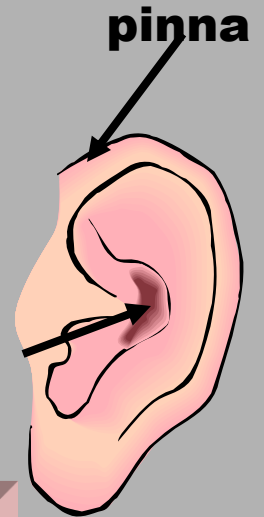
### External Ear

- **Auricle (pinna)**
  - funnel-like structure that leads through the temporal bone of the skull
- **External auditory meatus**
  - contains glands that secrete

external auditory meatus

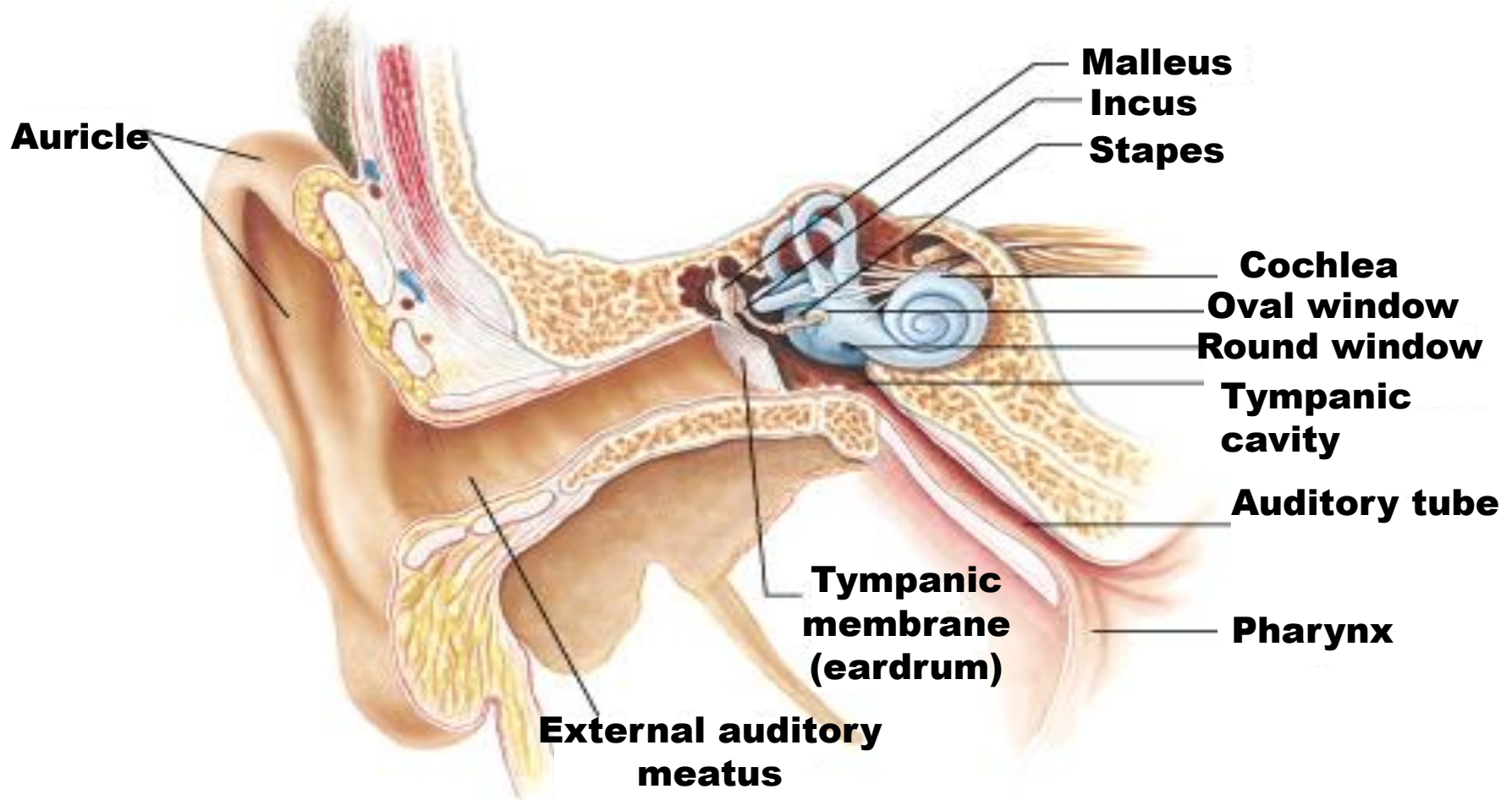
### Middle Ear

- **Tympanic cavity** where the tympanic membrane is located and the ossicles:
  - malleus (**hammer**)
  - incus (**anvil**)
  - stapes (**stirrup**)
- **Middle ear** connects to the pharynx through the eustachian tube which helps equalize air pressure



# Structure and Function

## Parts of the Ear



# Structure and Function

**osseus labyrinth**

**membranous labyrinth**

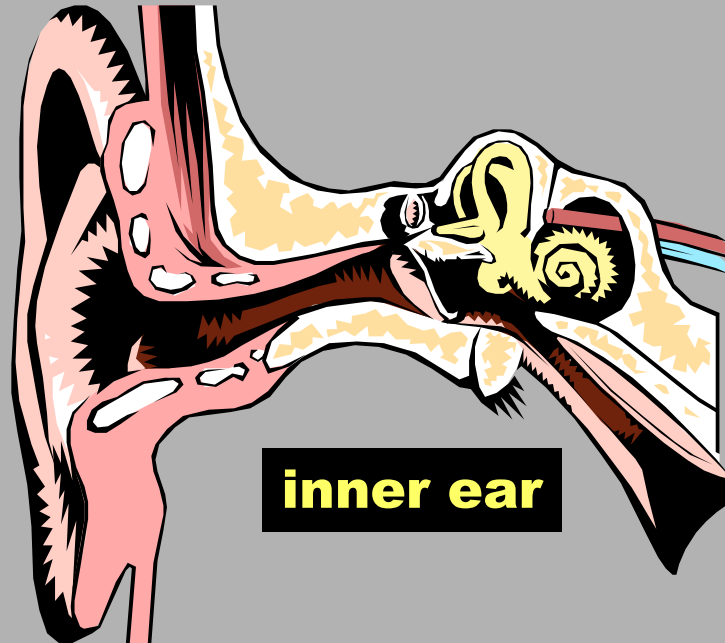
**perilymph**

**cochlea**

**inner ear**

**semicircular canals**

**endolymph**



# Structure and Function

## Cochlea

- **Snail-shaped structure located in the labyrinth**
- **Important for hearing**
  
- **Divides into:**
  - **scala vestibuli (leads from the oval window to the apex of the cochlea)**
  - **scala tympani (leads from the apex of the cochlea to the round window)**
  
- **Contains a basilar membrane that has hairlike receptor cells located in the organ of Corti on the membrane's surface**

**NOTE: The hairlike receptor cells move back and forth in response to sound waves .**

# Structure and Function

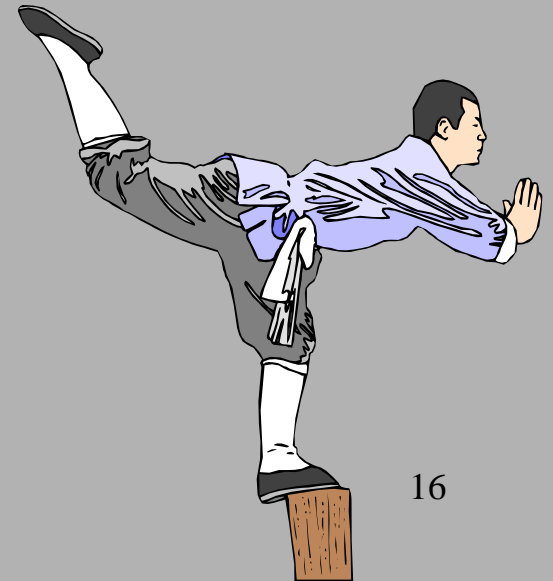


## Hearing

- The hairlike receptors located in the organ of Corti move back and forth in response to sound waves, then send messages via neurotransmitters to the brain for interpretation
- Sound intensity (**decibels**) heard by the normal ear ranges from 40 dB to 140 dB

## Equilibrium

- The ability to maintain a steady balance when still or moving
- Otoliths** are small calcifications that move to maintain gravitational balance





# Structure and Function

## Touch, Pain, and Temperature – the Skin

**Skin receptors can sense the following:**



**Touch**



**Pressure**



**Pain**



**Temperature**



**Injury**



# Structure and Function

## Smell - the Nose

**The sense of smell is activated by neurons called olfactory receptors which are covered with cilia.**



**Olfactory receptors are yellowish-brown masses along the top of the nasal cavity.**

# Structure and Function



## Taste - the Tongue and Oral Cavity

### Taste Buds

- organs that sense the taste of food
- located on the surface of the tongue, roof of mouth, and walls of the pharynx
- contain receptor cells called taste cells

## Four Types of Taste Buds

•sweet

•salty

•bitter

•sour

# Combining Forms and Abbreviations

## Combining Form

## Meaning

**audi (o)** → **hearing**

**aur (o)** → **hearing**

**blephar (o)** → **eyelid**

**cerumin (o)** → **wax**

**cochle (o)** → **cochlea**

**conjunctiv (o)** → **conjunctiva**

**cor (o)** → **pupil**

# Combining Forms and Abbreviations

## Combining Form

## Meaning

**corne (o)** → **cornea**

**cycl (o)** → **ciliary body**

**dacry (o)** → **tears**

**ir (o)** → **iris**

**kerat (o)** → **cornea**

**lacrim (o)** → **tears**

**mastoid (o)** → **mastoid process**

# Combining Forms and Abbreviations

## Combining Form

## Meaning

**myring(o)** •————• **ear drum, middle ear**

**nas(o)** •————• **nose**

**ocul(o)** •————• **eye**

**ophthalm(o)** •————• **eye**

**opt(o)** •————• **eye**

**ossicul(o)** •————• **ossicle**

**phac(o)** •————• **lens**

# Combining Forms and Abbreviations

## Combining Form

## Meaning

<b>pupill(o)</b>	→	<b>pupil</b>
<b>retin(o)</b>	→	<b>retina</b>
<b>scler(o)</b>	→	<b>white of the eye</b>
<b>scot(o)</b>	→	<b>darkness</b>
<b>tympan(o)</b>	→	<b>eardrum, middle ear</b>
<b>uve(o)</b>	→	<b>uvea</b>

# Combining Forms and Abbreviations

## Abbreviation

## Meaning

**acc.** - - - - - accommodation

**AD** - - - - - right ear

**ARMD** - - - - - age-related macular degeneration

**AS** - - - - - left ear

**AU** - - - - - both ears

**D** - - - - - diopter

**dB** - - - - - decibel



# Combining Forms and Abbreviations

## Abbreviation

## Meaning

**DVA** → **distance visual acuity**

**ECCE** → **extracapsular cataract extraction**

**EENT** → **eye, ear, nose, and throat**

**ENT** → **ear, nose, and throat**

**ICCE** → **intracapsular cataract  
cryoextraction**

**IOL** → **intraocular lens**

**IOP** → **intraocular pressure**

# Combining Forms and Abbreviations

## Abbreviation

## Meaning

**NVA** \_\_\_\_\_ **near visual acuity**

**OD** \_\_\_\_\_ **right eye**

**OM** \_\_\_\_\_ **otitis media**

**OS** \_\_\_\_\_ **left eye**

**OU** \_\_\_\_\_ **each eye**

**PERRLA** \_\_\_\_\_ **pupils equal, round, reactive to light and accommodation**

# Combining Forms and Abbreviations

## Abbreviation

## Meaning

**PE tube** → **polyethylene ventilating tube  
(placed in the eardrum)**

**SOM** → **serious otitis media**

**VA** → **visual acuity**

**VF** → **visual field**

**+** → **plus/convex**

**-** → **minus/concave**

# Diagnostic, Procedural, and Laboratory Terms

## Diagnosing the Eye

**Eye examinations can be performed by both an ophthalmologist and an optometrist.**

## Visual Acuity

- **The most common diagnostic test for the eye**
- **The most common eye chart is the Snellen Chart**
- **20/20 is considered perfect vision**



# Diagnostic, Procedural, and Laboratory Terms

## Other Tests

### Peripheral Vision

- The area one is able to see to the side with the eyes looking straight ahead

### Tonometry

- Measurement of pressure in the eye
- Tests for glaucoma

### Ophthalmoscopy

- Visual examination of the interior of the eye

# Diagnostic, Procedural, and Laboratory Terms



A **slit lamp** ocular device is used to view the interior of the eye magnified through a microscope.

**NOTE: Fluorescein angiography** is the injection of a contrast medium into the blood vessels to observe blood flow throughout the eye.

# Diagnostic, Procedural, and Laboratory Terms

## Diagnosing the Ear

An **otologist** is an ear specialist and an **audiologist** is a nonmedical hearing specialist.



## Ear Examination

- **Otoscopy** is a visual examination of the ear using an otoscope
- **Audiometer** measures various acoustic frequencies to test hearing
- **Pneumatic otoscope** is an otoscope that allows air to be blown into the ear

# Diagnostic, Procedural, and Laboratory Terms

An **otoscope** is a lighted viewing device.



A **tuning fork** compares the conduction of sound in one ear or between the two ears.

- The Rinne test

- The Weber test



# Diagnostic, Procedural, and Laboratory Terms

## Diagnosing Other Senses

**Loss of taste, touch, or smell may be due to a disease process or may be caused by aging.**

**The tongue and other parts of the mouth and skin are observed during a general examination.**



# Pathological Terms



## Eye Disorders

**Corrective lenses are used to treat the most common disorders such as:**

- **Defects in the curvature of the cornea and/or lens**
- **Defects in the refractive ability of the eye due to abnormally short or long eyeballs**



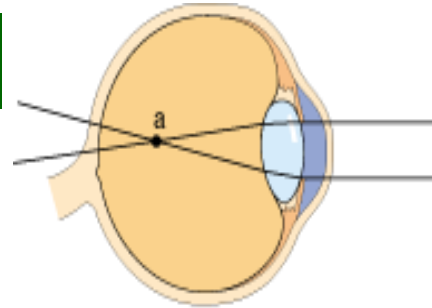
**Corrective lenses may be worn on the face or directly over the cornea as with **contact lenses**.**

# Pathological Terms

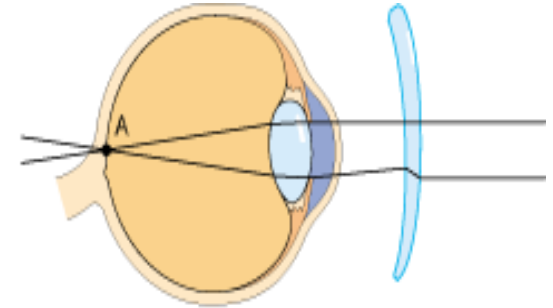
## Errors of Refraction

### Astigmatism

- Distortion of sight because light rays do not come to a single focus on the retina



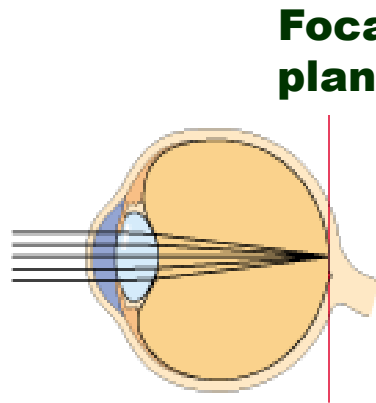
Astigmatism



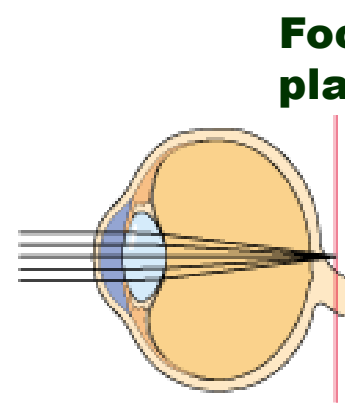
Correction

### Hyperopia

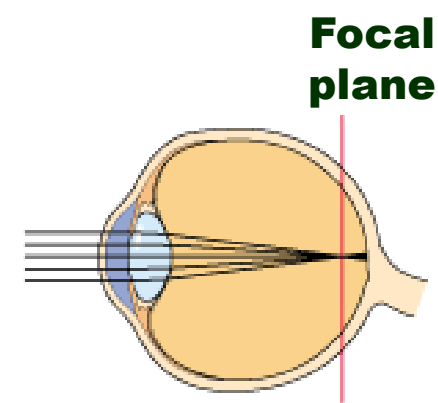
- Far sightedness



(normal)



Hyperopia  
(uncorrected)



Myopia  
(uncorrected)

### Myopia

- Near sightedness

# Pathological Terms

## Other Conditions

### Strabismus

- **Eye misalignment, also called “cross-eyed”**
- **Esotropia** is deviation of one eye inward
- **Exotropia** is deviation of one eye outward

### Presbyopia

- **Loss of close reading vision, common after age 40**

### Diplopia

- **Double vision**

### Asthenopia

- **Condition in which the weakness of the ocular or ciliary muscles cause the eyes to tire easily**

### Photophobia

- **Extreme sensitivity to light**

# Pathological Terms

## Eye Disorders Cont'd

### Cataracts

- Cloudiness of the lens
- **Aphakia** results when the lens is removed
- **Pseudophakia** is an implanted lens

### Glaucoma

- Abnormally high pressure in the eye
- Treated with certain eye medications or surgery
- Loss of vision can occur if it is not treated

### Other Causes of Blindness

- Congenital defects
- Trauma to the eyes
- Macular degeneration

**NOTE: Vision corrected only to 20/400 may be considered legally blind.**

# Pathological Terms

## Eye Disorders Cont'd

- **Exophthalmus** →

- protrusion of the eyeball
- usually caused by hyperthyroidism

- **Nystagmus**

- excessive eyeball movement

- **Epiphora**

- excessive tearing
- also called lacrimation



# Pathological Terms

## Inflammations and Eyelid Conditions

```
graph TD; A((Inflammations and Eyelid Conditions)) --> B[blepharospasm]; A --> C[conjunctivitis]; A --> D[blepharoptosis]; A --> E[hordeolum]; A --> F[trichiasis]; A --> G[bleparochalasis];
```

### blepharospasm

- Involuntary eyelid movement

### conjunctivitis

- Highly infectious inflammation of the conjunctiva

### bleparochalasis

- Loss of elasticity of the eyelid

### blepharoptosis

- Paralysis of the eyelid

### hordeolum

- Infection of a sebaceous gland in the eyelid

### trichiasis

- Abnormal growth of eyelashes

# Pathological Terms

## Ear Disorders

### Anacusis

- Total loss of hearing

### Paracusis

- Impaired hearing

### Presbycusis

- Age related hearing loss

### Otosclerosis

- Hardening of bone within the ear

### Tinnitus

- Constant ringing or buzzing in the ear

### Otalgia

- Ear ache



# Pathological Terms

## Ear Disorders (cont'd)

### Term

### Meaning

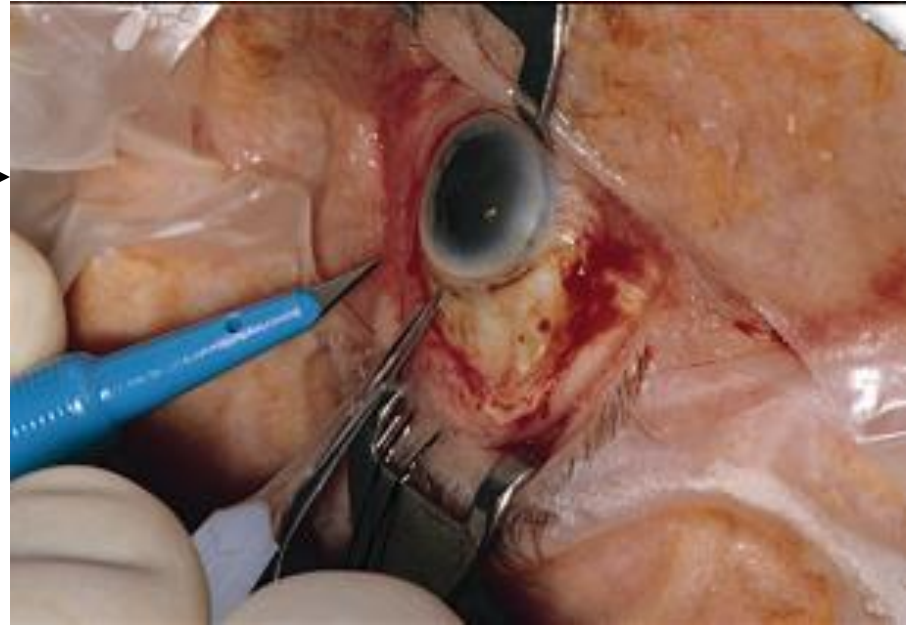
- **vertigo** ————— **dizziness**
- **otitis media** ————— **inflammation of the middle ear**
- **labyrinthitis** ————— **inflammation of the labyrinth**
- **myringitis** ————— **inflammation of the eardrum**
- **mastoiditis** ————— **inflammation of the mastoid process**
- **Meniere's disease** ————— **increased fluid pressure in the cochlea**



# Surgical Terms

## Cataract Extraction

Removal of the cloudy lens from the eye; usually followed by an intraocular lens implant



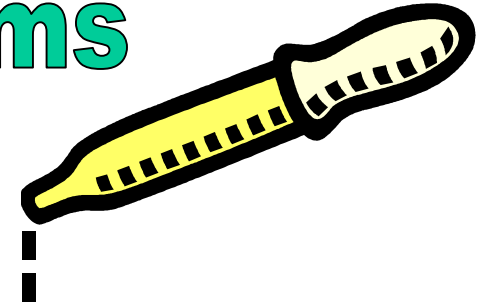
## Other Procedures

- **Blepharoplasty**
- **Otoplasty**
- **Dacryocystectomy**

- **Trabeculectomy**
- **Cryoretinopexy**
- **Myringotomy**

# Pharmacological Terms

**The eyes and ears can both be treated with medicated drops**



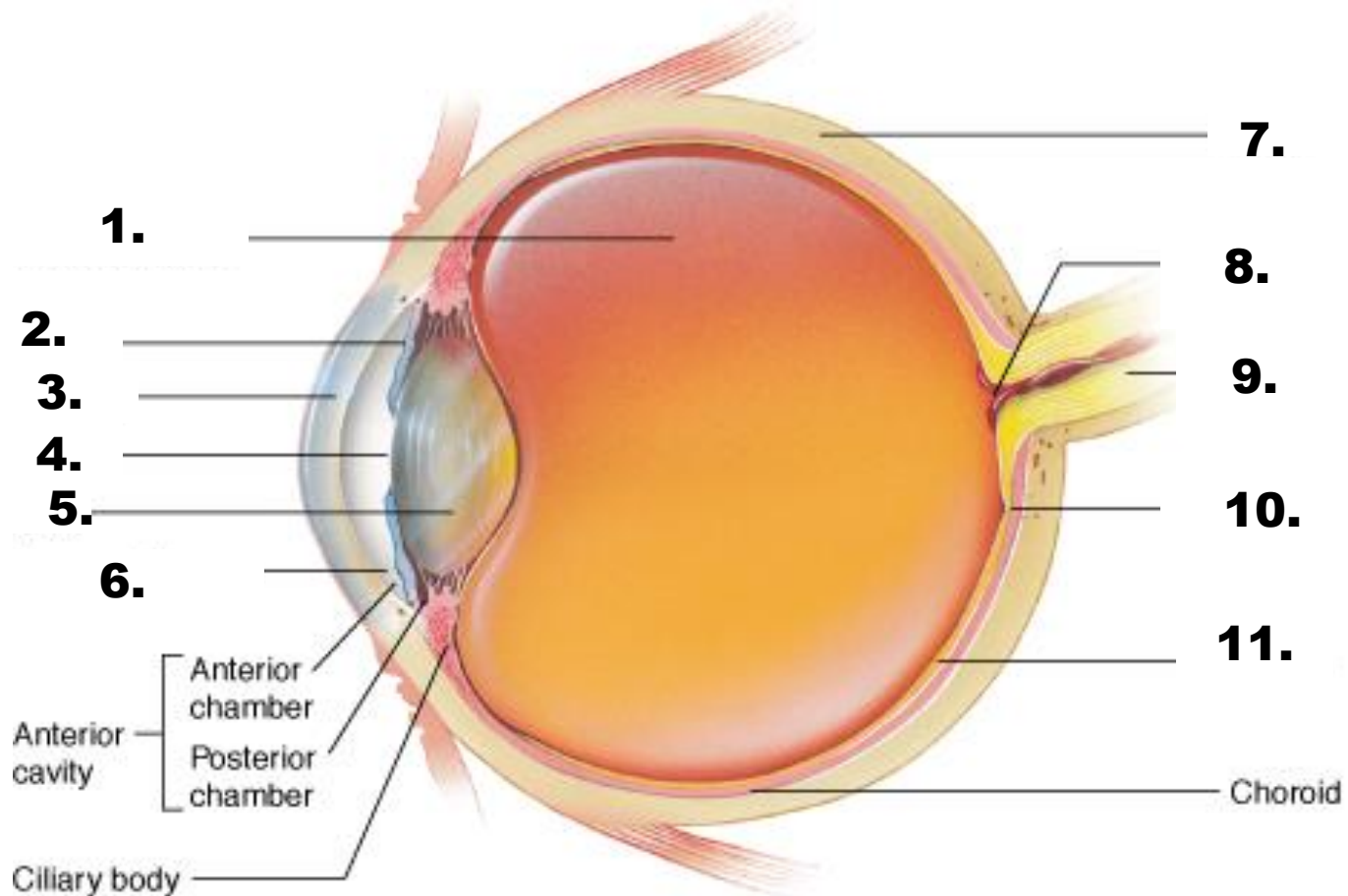
## Medication

## Purpose

<b>antiseptic ear drops</b>	—————→	<b>cleanse the ears</b>
<b>anti-inflammatory ear drops</b>	—————→	<b>reduce swelling</b>
<b>eye drops</b>	—————→	<b>reduce eye congestion</b>
<b>miotic</b>	—————→	<b>contracts the pupil</b>
<b>mydriatic</b>	—————→	<b>dilates the pupil</b>
<b>nasal decongestant</b>	—————→	<b>reduces nasal congestion</b>

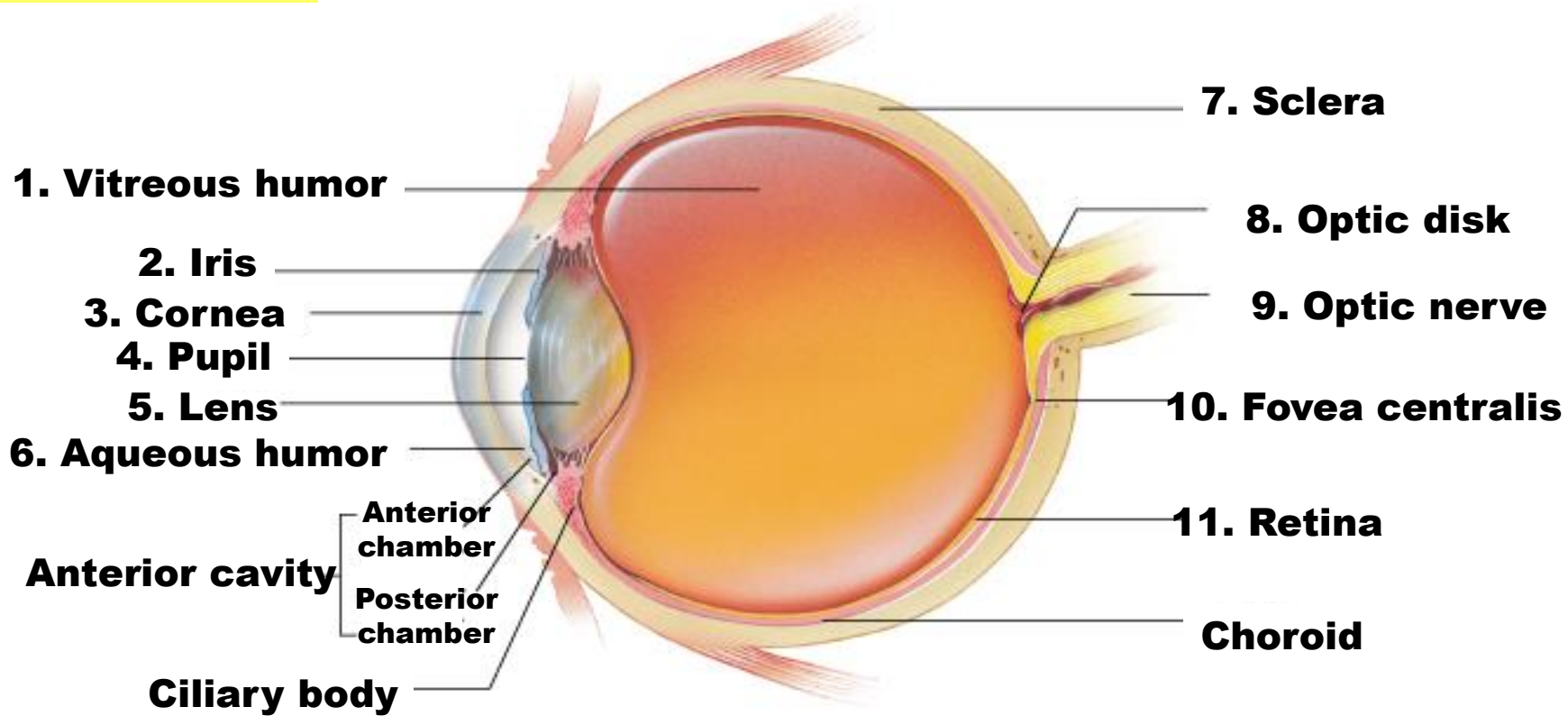
# Apply Your Knowledge

Identify the labeled structures of the eye in this diagram.



# Apply Your Knowledge

## Answers



# Apply Your Knowledge

**Which of the following eye structures has no blood supply?**

**A. eyelid**

**B. cornea**

**C. sclera**

**Answer: B. cornea**

# Apply Your Knowledge

Which of the following is the “colored” part of the eye?

**A. iris**

**B. lens**

**C. pupil**

**Answer: A. iris**

# Apply Your Knowledge

**Dana is traveling on an airplane for the first time. She becomes concerned with the strange feelings in her ears. Which of the following statements, if made to Dana, would be correct?**

- A. The high altitude alters the pressure in the middle ear.**
- B. The vibrations from the plane cause a build-up of cerumen.**
- C. The low altitude causes inflammation of the cochlea nerve.**

**Answer: A. The high altitude alters the pressure in the middle ear.**



# Apply Your Knowledge

**Mrs. Harrell is scheduled to visit her Ophthalmologist for an eye examination. She was instructed to put eye drops in her eyes right before the appointment, to assist with the internal examination of her eye.**

**Which of the following medicated drops might she be required to install prior to the exam?**

**A. miotic**

**B. mydriatic**

**Answer: B. mydriatic**