LaFleur Brooks' Health Unit Coordinating

7th edition

Chapter 22

Medical Terminology, Basic Human Structure, Diseases, and Disorders

Lesson 22.4

Unit 4: The Nervous System

1. Identify the two divisions of the nervous system and identify the structures of each division.
2. Describe the overall functions of the nervous system.
3. Describe the structure and functions of the organs of the nervous system.
4. Describe the function of the meninges and identify and describe the three layers of the meninges.

Lesson 22.4

Unit 4: The Nervous System (cont'd)

5. Discuss a cerebrovascular accident (CVA), a transient ischemic attack (TIA), Parkinson disease, Alzheimer disease, Amyotrophic lateral sclerosis (ALS), and epilepsy.
6. Read the objectives related to medical terminology and demonstrate ability to meet the objectives by correctly completing Exercises 1 through 11.
7. Define the unit abbreviations.

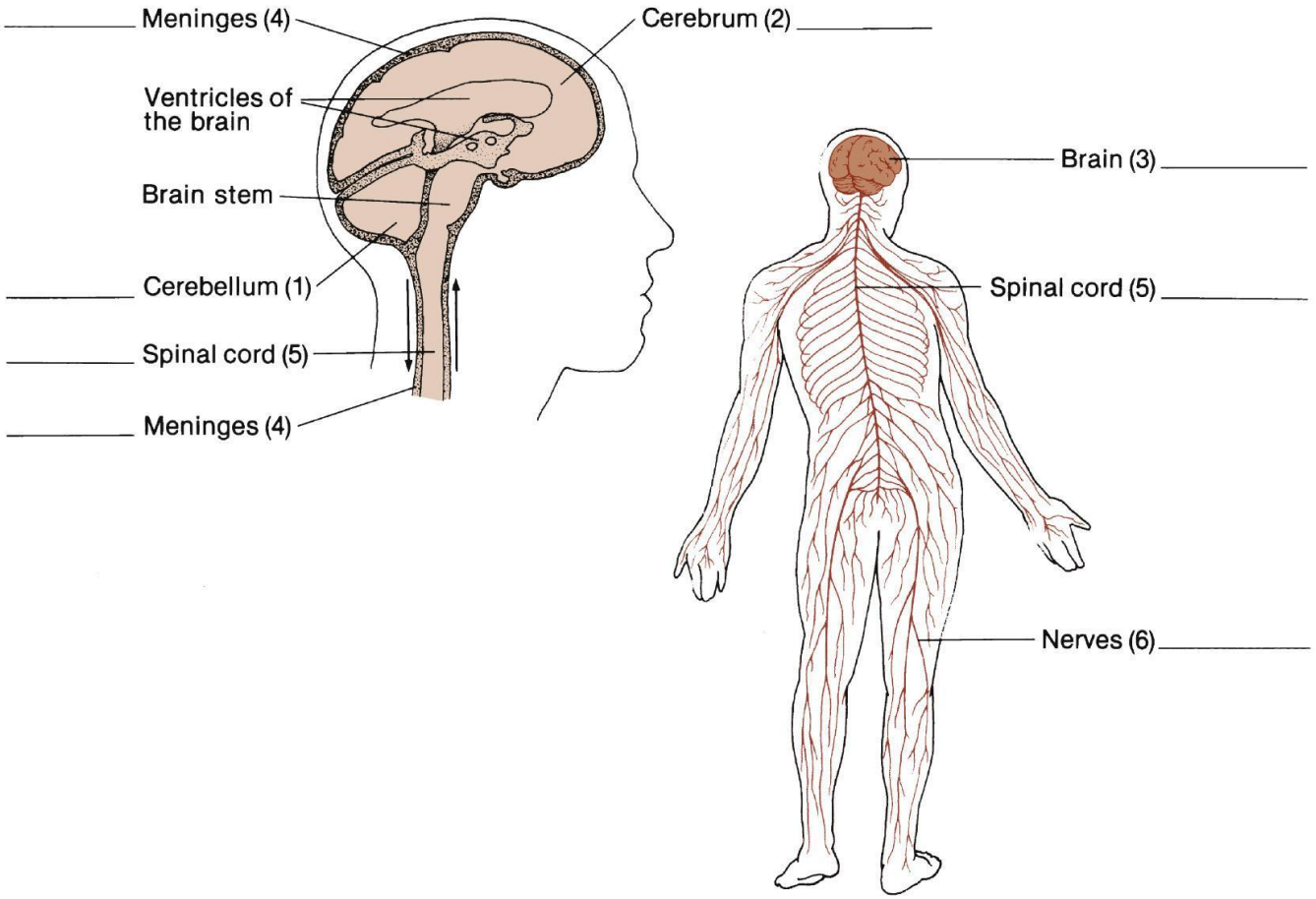
Divisions of the Nervous System

- Central Nervous System (CNS): consists of the brain and spinal cord
- Peripheral Nervous System (PNS): consists of the nerves of the body (12 pairs of cranial nerves and 31 pairs of spinal nerves)

Functions of the Nervous System

- Monitors, regulates, and controls the functions of body organs and body systems by using nerve impulses to transmit information from one part of the body to another
- The nervous system works in concert with the endocrine system to maintain homeostasis, a constant internal environment, by inhibiting or stimulating the release of hormones.

The Nervous System



Structure and Function of the Organs of the Nervous System

- Nerve: cord-like structure that is located outside the CNS
  - Contains nerve cells called neurons
  - The neuron transmits nerve impulses from one part of the body to another.
- Two types of neurons:
  - Sensory: transmit impulses to the brain and spinal cord
  - Motor: transmit impulses from the brain and spinal cord to the muscles or glands

Structure and Function of the Organs of the Nervous System, cont'd

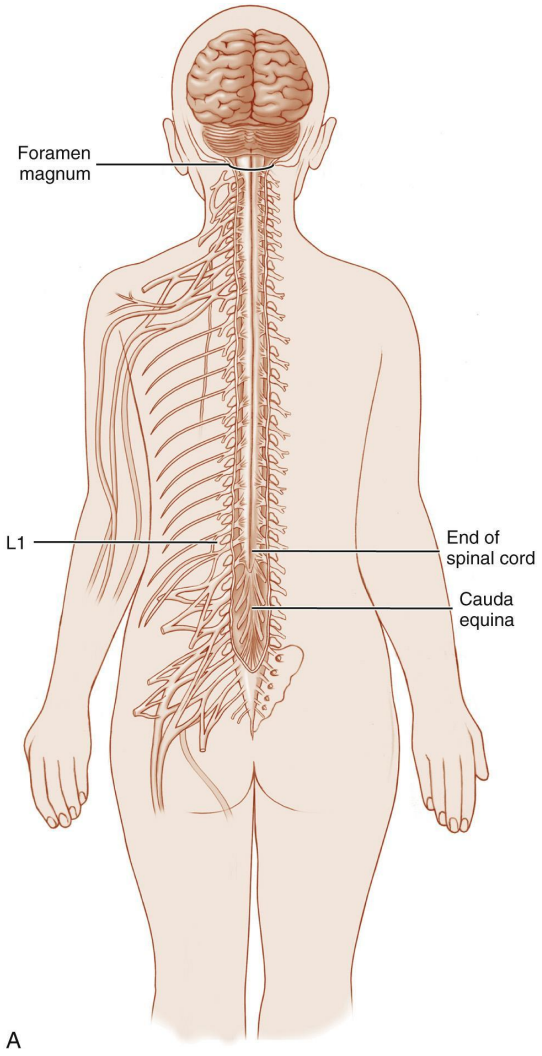
- Brain: located within the cranial cavity
  - The main center for coordinating body activities
- Three parts include:
  - 1. Cerebrum: largest part of the brain – located in the upper portion of the cranium – contains sensory, motor, sight, and hearing centers – memory, intellect, judgment, and emotional reactions also take place in the cerebrum.
  - 2. Cerebellum (little brain): assist in the coordination of voluntary muscles and to maintain balance

Structure and Function of the Organs of the Nervous System, cont'd

- 3. Brainstem: three main parts include midbrain, pons, and medulla oblongata.
  - Contains the nerve fibers that form the connecting links between the different parts of the brain and the centers that control three vital functions: blood pressure, respiration, and heartbeat

- Spinal Cord: extends from the brainstem and passes through the spinal cavity to between the first and second lumbar vertebrae
  - Pathway for conducting sensory impulses up to the brain and motor impulses down from the brain

Location and Length of Spinal Cord



Function and Structure of the Meninges

- Made up of three layers of connective tissue that completely surround and protect the spinal cord and brain
  - dura mater: outer tougher layer
  - arachnoid (mater): middle layer – a web-like structure
  - pia mater: inner thin, tender layer – carries blood vessels that provide nourishment to the nervous tissue

Cerebral Vascular Accident (CVA) (Stroke)

- Interference of blood flow to the brain, which reduces the supply of oxygen and nutrients, causing damage to brain tissue
- Major causes are embolism, thrombosis, and hemorrhage; damage to brain tissue varies according to the artery affected.
- Paralysis may range from slight to complete hemiplegia (paralysis of one side of the body).

Cerebral Vascular Accident (CVA) (Stroke), cont'd

- CVA of the left hemisphere of the brain produces symptoms on the right side of the body, and CVA of the right side of the brain produces symptoms on the left side of the body.
- The more quickly the circulation returns, the better the chance for recovery.

Stroke Warning Signs and Treatment

- Sudden numbness, weakness, or paralysis of the face, arm, or leg, especially on one side of the body
- Sudden confusion; problems with memory or perception
- Sudden loss of speech; difficulty speaking or understanding
- Sudden trouble seeing out of one or both eyes; blurred or double vision
- Sudden difficulty walking, dizziness, or loss of balance or coordination
- Sudden, severe headache with no known cause

Transient Ischemic Attacks (TIAs)

- Recurrent episodes of decreased neurologic function that occur as double vision, slurred speech, weakness in the legs, and dizziness lasting from seconds to 24 hours, then clearing.
- Considered warning signs for strokes
  - Caused by small emboli that temporarily interrupt blood flow to the brain
- Treatment includes administration of aspirin and anticoagulants to minimize thrombosis in the hope of preventing a CVA.

Parkinson Disease

- A gradual progressive disorder of the CNS
- Also called shaking palsy, parkinsonism, and paralysis agitans
- Occurs with degeneration of the dopamine-releasing neurons in the substantia nigra, an area of the brain
- Dopamine, one of the chemical messengers (neurotransmitters) responsible for transmitting signals within the brain, initiates and controls movement and balance.

Parkinson Disease, cont'd

- Symptoms: rigidity, tremors, and a shifting gait – deterioration is progressive.
- No cure is known; treatment is aimed at relieving symptoms and promoting function for as long as possible.
- Does not impair intellect

Alzheimer Disease

- Also called presenile dementia
- Characterized by confusion, mental deterioration (dementia), restlessness, hallucinations, and the inability to carry out purposeful speech and movement
  - The patient may lose bowel and bladder control and refuse to eat.
- The disease is progressive and usually begins in later midlife.
- Precise cause has not been identified, so definitive treatment has not been established.

Amyotrophic Lateral Sclerosis (ALS) "Lou Gehrig's Disease"

- A neurodegenerative disease that affects nerve cells in the brain and the spinal cord
- “*A-myo-trophic*” "A" means no or negative. "*myo*" refers to muscle, and "*trophic*" means nourishment –"*No muscle nourishment*."
  - When a muscle has no nourishment, it "atrophies" or wastes away.
- "*Lateral"* identifies the areas in a person's spinal cord where portions of the nerve cells that signal and control the muscles are located.

Amyotrophic Lateral Sclerosis (ALS) "Lou Gehrig's Disease", cont'd

- As this area degenerates, it leads to scarring or hardening ("sclerosis") in the region.
- When the motor neurons die, the ability of the brain to initiate and control muscle movement is lost.
- With voluntary muscle action progressively affected, patients in the later stages of the disease may become totally paralyzed.

Epilepsy

- A group of chronic disorders of the CNS
- Result of abnormal electrical (neuron) activity in the brain
- Usually occurs in childhood or after age 50
- Can be classified as idiopathic (origin unknown) or acquired
- Some of the known causes of acquired epilepsy are brain tumors, brain injury, and endocrine disorders.

Stages of Seizures

- Preictal: patient may experience abnormal somatic and psychic sensations, including strange sounds, tastes, and smells – these sensations are called an aura.
- Interictal: includes violent jerking of some parts of or the total body
- Postictal: during this stage, the patient may become confused and lethargic and may report headache and sore muscles.

Unit 4 Abbreviations

CNS	central nervous system
CSF	cerebral spinal fluid
CT	computed tomography
CVA	cerebral vascular accident
EEG	electroencephalography
EP	evoked potentials
LP	lumbar puncture
MRI	magnetic resonance imaging
MS	multiple sclerosis

Unit 4 Abbreviations, cont'd

PET	positron emission tomography
PNS	peripheral nervous system
TIA	transient ischemic attack

Lesson 22.5

Unit 5: The Eye and the Ear

1. Describe the function and structure of the eye.
2. List five body structures that help protect the eye.
3. Identify and describe the parts and accessory structures of the eye and briefly describe the function of each part.
4. Name and describe the functions of the two types of nerve cells located in the retina.
5. Describe the location and functions of the aqueous and vitreous humor.

Lesson 22.5

Unit 5: The Eye and the Ear (cont'd)

6. List in order, beginning with the conjunctiva, the organ of the eye through which light rays travel to the retina.
7. Discuss cataract, glaucoma, retinal detachment, and macular degeneration.
8. Describe two functions of the ear.
9. List the parts of the outer ear, middle ear, and the inner ear.
10. Trace the travel of sound waves from the outside environment to the brain.

Lesson 22.5

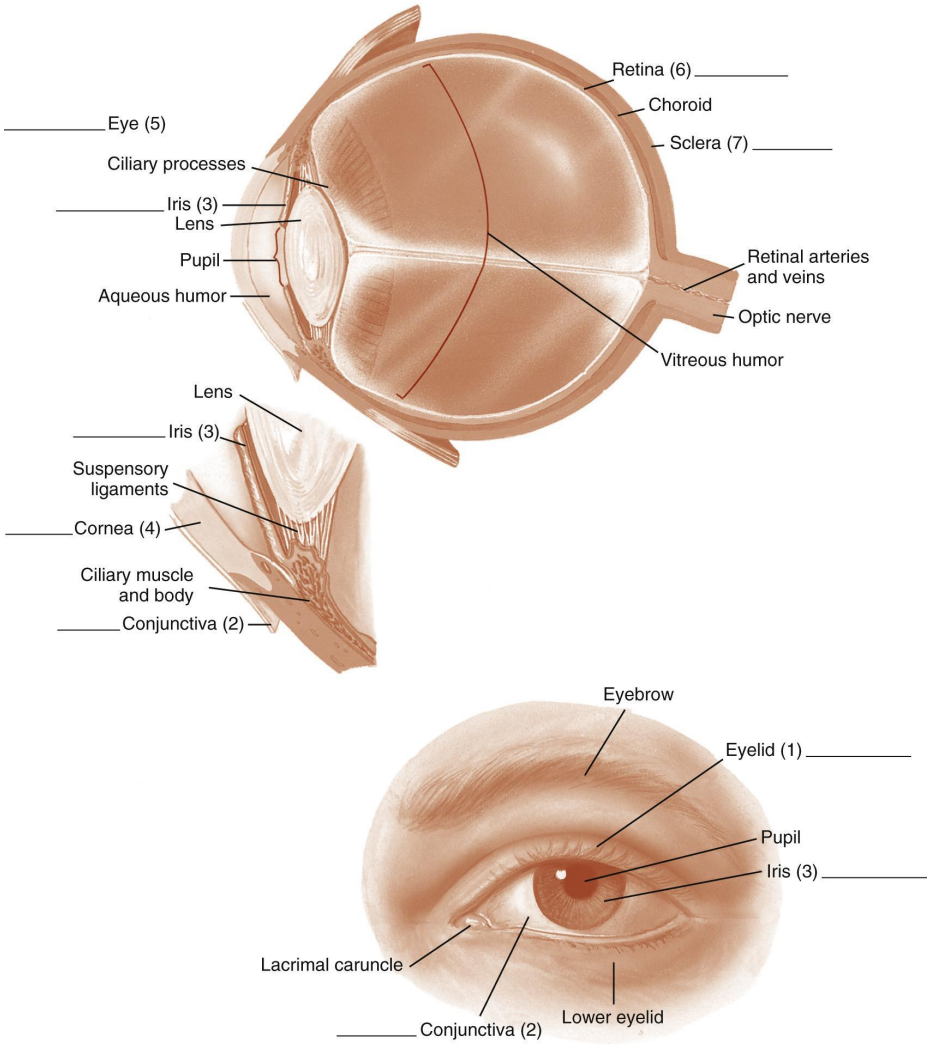
Unit 5: The Eye and the Ear (cont'd)

11. Describe and discuss two treatments for tinnitus.
12. Read the objectives related to medical terminology and demonstrate ability to meet the objectives by correctly completing Exercises 1 through 8.
13. Define the unit abbreviations.

Function and Structure of the Eye

- The organ of vision
- Receives light waves that are focused on the retina and produces visual nerve impulses that are transmitted to the visual area of the brain by the optic nerve
- The eye is divided into three layers:
  - Sclera: outer protective layer
  - Choroid: contains blood vessels that supply nutrients to the eye
  - Retina: inner layer of the eye

The Eye


Retina (6)
Choroid
Sclera (7)
Eye (5)
Ciliary processes
Iris (3)
Lens
Pupil
Aqueous humor
Retinal arteries and veins
Optic nerve
Vitreous humor
Lens
Iris (3)
Suspensory ligaments
Cornea (4)
Ciliary muscle and body
Conjunctiva (2)
Eyebrow
Eyelid (1)
Pupil
Iris (3)
Lacrimal caruncle
Conjunctiva (2)
Lower eyelid

Body Structures that Help Protect the Eye

- Skull bones
- Eyelashes (close eyelids when disturbed)
- Eyelids (protect and shade)
- Lacrimal apparatus (glands secrete lubricating tears)
- Conjunctiva (protective membrane) protects the eye from harmful bacteria.

Accessory Structures of the Eye

- The iris and the ciliary muscle make up the anterior middle portion of the choroid.
- The iris is the colored portion of the eye; has an opening in the center called the pupil.
- Muscles of the iris regulate:
  - The amount of light entering the eye through dilatation
  - Contraction of the pupil
- The lens focuses light rays on the retina.
  - The ciliary muscle regulates the shape of the lens to make this possible.

Types of Nerve Cells Located in the Retina

- The retina is the inner layer of the eye.
- Nerve cells, or photoreceptor neurons responsible for the adaptation to light
  - Cones: sensitive to bright light and are responsible for color vision
  - Rods: far more numerous than cones, adapt to provide both peripheral vision and vision in dim light

Aqueous and Vitreous Humor

- The anterior and posterior cavities inside the eyeball are filled with fluid.
- The anterior and posterior chambers in front of the lens are filled with:
  - Aqueous humor: constantly formed and drained
- The large posterior cavity behind the lens is filled with:
  - Vitreous humor: remains relatively constant
- Functions of fluids are:
  - To maintain the shape of the eyeball with proper intraocular pressure
  - To assist in bending the light rays to focus on the retina

Pathway of Light Rays

conjunctiva → cornea → aqueous humor →
pupil → lens → vitreous humor → retina →
optic nerve (converted to nerve impulses) →
cerebrum

Cataracts

- Gradual development of cloudiness of the lens of the eyes
- Usually occurs in both eyes and develops after 50 years of age
- At first, vision is blurred; if not treated, cataracts eventually lead to loss of eyesight.
- Two types of surgery used to remove cataracts are extraction of the entire lens and phacoemulsification.

Glaucoma

- The abnormal increase in intraocular (within the eye) pressure
  - Pressure is caused by overproduction of aqueous humor or obstruction of its outflow, which causes damage to the retina that results in blindness.
- Preventable

Glaucoma, cont'd

- Two forms:
  - Chronic: affects vision gradually and may not be diagnosed until after some loss of vision has occurred
  - Acute: causes severe pain and sudden dimming of vision
- Treatment varies, but often is treated with drugs that help to reduce intraocular pressure.

Retinal Detachment

- The separation of the retina from the choroid in the back of the eye, which allows vitreous humor to leak between the choroid and the retina
- May be caused by trauma but is often the result of aging
- Treatment: surgical procedures used are photocoagulation, cryosurgery, and scleral buckling.

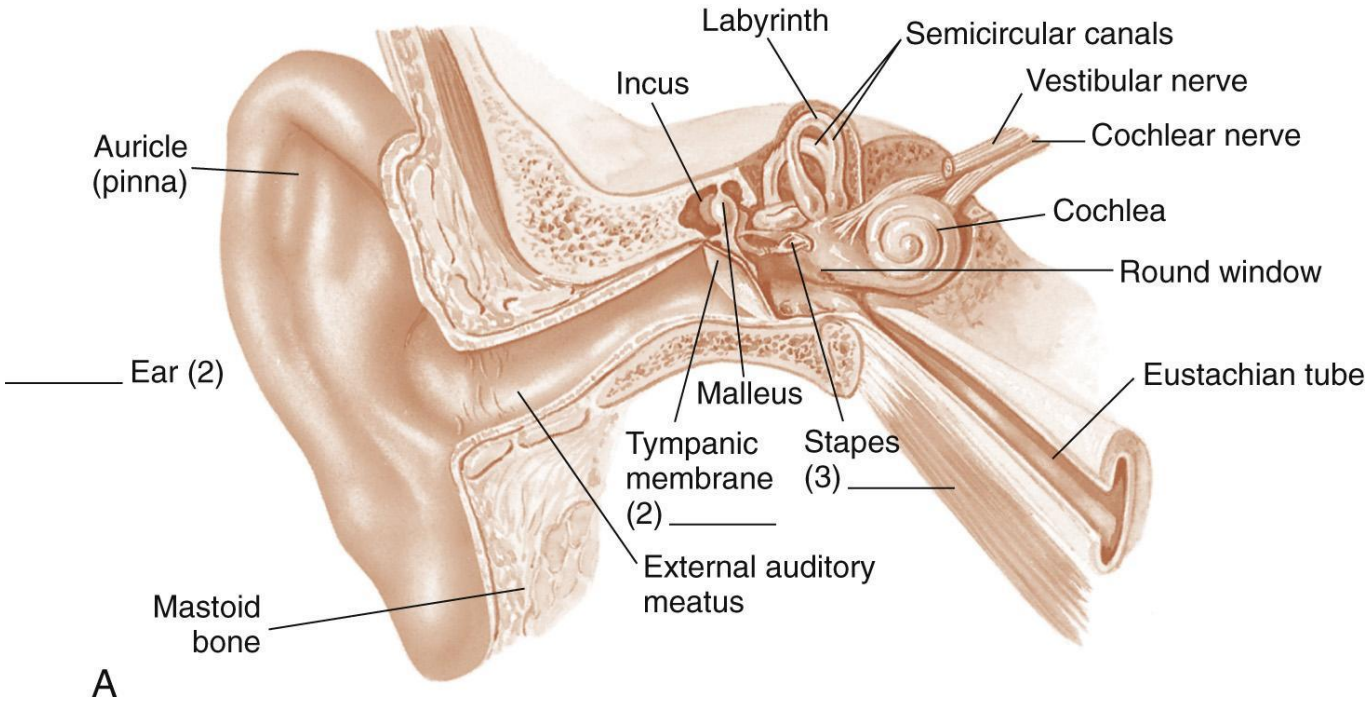
Macular Degeneration

- The loss of vision in the center of the visual field due to damage to the retina
- More common in adults over the age of 50 (Age-related Macular Degeneration or AMD)
- Treatment: no medical or surgical treatment is currently available, but some vitamin supplements high in antioxidants may slow the progression of the disease.

Function and Structure of the Ear

- Two functions of the ear include:
  - Hearing
  - Equilibrium (sense of balance)
- The ear is divided into three main parts:
  - The outer ear
  - The middle ear
  - The inner ear

The Ear


Labyrinth
Semicircular canals
Incus
Vestibular nerve
Auricle (pinna)
Cochlear nerve
Cochlea
Round window
Ear (2)
Eustachian tube
Malleus
Tympanic membrane (2)
Stapes (3)
External auditory meatus
Mastoid bone
A

Outer Ear

- Made up of two parts:
  - Pinna or auricle: the appendage we see on each side of the head
  - Auditory canal: the tube that leads from the outer ear to the middle ear through which sound waves pass

Middle Ear

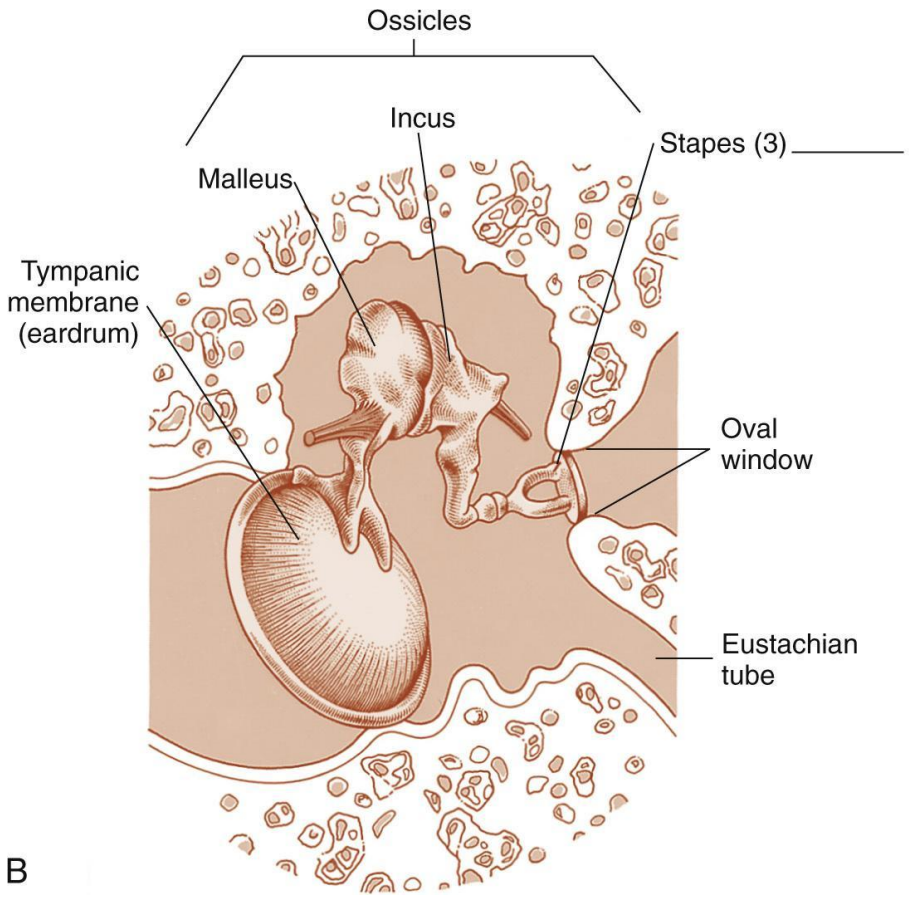
- Tympanic membrane (eardrum): separates the outer ear from the middle ear
- Ossicles: three small bones called malleus, incus, stapes, which form a chain across the middle ear from the tympanic membrane to the oval window
  - They transfer vibrations of the eardrum to the inner ear.
- Eustachian tube: leads from the middle ear to the pharynx (throat)
  - Serves to equalize pressure on both sides of the tympanic membrane

Inner Ear (or Labyrinth)

- Oval window: separates the middle ear from the inner ear
- Cochlea: located next to the oval window – shaped like a snail, with receptors for hearing
    - It contains special fluids that carry sound vibrations.

Semicircular canals: the cerebellum interprets impulses from the semicircular canals to maintain balance and equilibrium.

Inner Ear


Ossicles
Incus
Stapes (3)
Malleus
Tympanic membrane (eardrum)
Oval window
Eustachian tube
B

Pathway of Sound Waves Through the Ear

pinna → auditory canal → tympanic membrane → ossicles (malleus, incus, stapes) → oval window → cochlea → auditory nerve (converted to nerve impulses) → cerebrum

Tinnitus

- A symptom in most disorders of the ear; is described as a ringing, buzzing, or roaring noise in the ears
- Common causes of tinnitus include chronic infection, head injury, prolonged exposure to loud environmental noise, hypertension, cardiovascular disease, or intake of drugs that are ototoxic.
- Persistent and severe noises in the ear can interfere with the person's ability to carry on normal activities such as resting and sleeping.

Tinnitus Treatment

- Audiologic and vascular examination to try to determine the underlying cause of the tinnitus
- Many cases have been unresponsive to all conventional methods of treatment.
  - Treatments used:
    - Attempts to mask ear noises by providing soft background music
    - Biofeedback has been marginally effective in cases caused by stress or hysteria.

Unit 5 Abbreviations

ENT Ear, nose and throat specialist (otorhinolaryngologist)

OD oculus dexter (right eye)

OM otitis media (middle ear infection)

OS oculus sinister (left eye)

OU oculus uterque (both eyes)

PEERLA pupils equal, round, reactive to light and accommodation

PRK photorefractive keratectomy

RK radial keratotomy