

TABLE 14.2

Summary of Functions of Principal Parts of the Brain

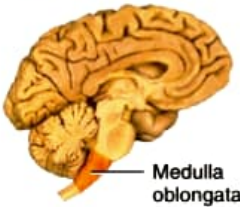
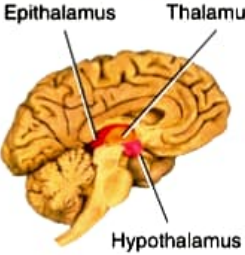
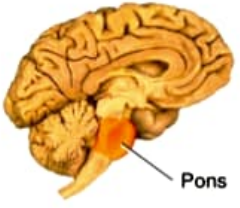
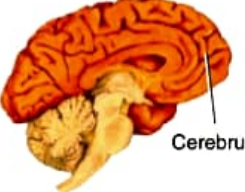
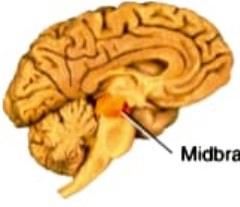

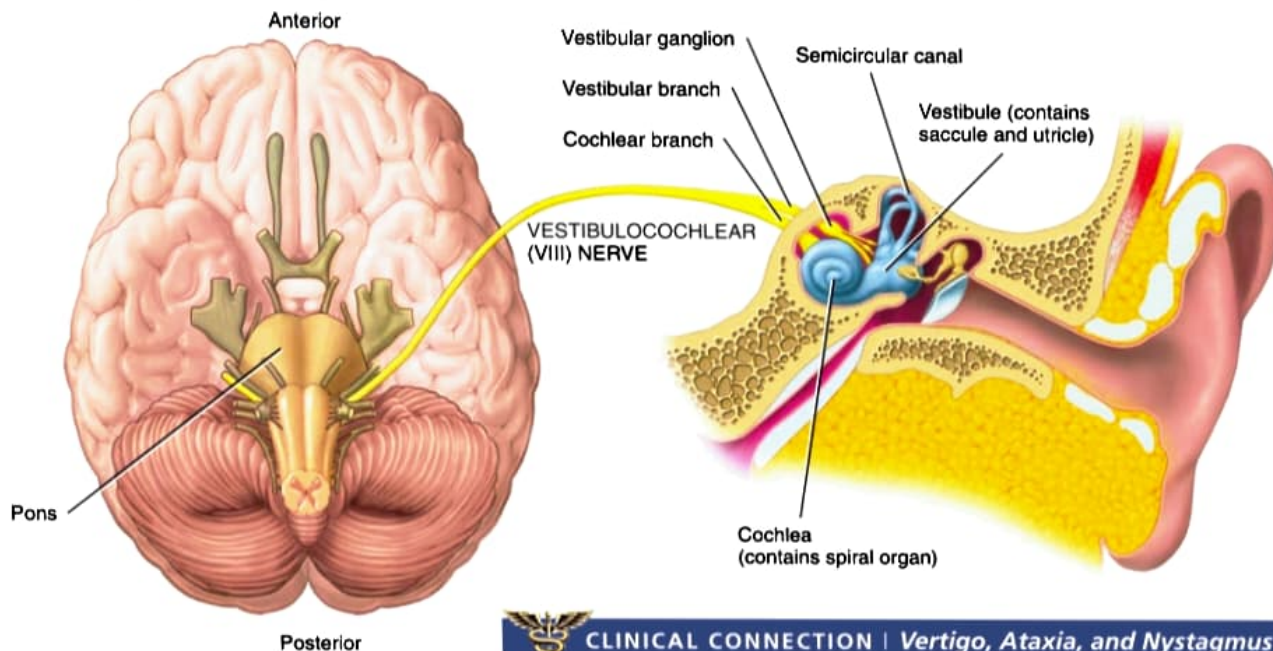
PART	FUNCTION	PART	FUNCTION
BRAIN STEM		DIENCEPHALON	
	Medulla oblongata: Contains sensory (ascending) and motor (descending) tracts. Cardiovascular center regulates heartbeat and blood vessel diameter. Medullary rhythmicity area (together with pons) regulates breathing. Contains gracile nucleus, cuneate nucleus, <u>gustatory</u> nucleus, cochlear nuclei, and vestibular nuclei (components of sensory pathways to brain). Inferior olivary nucleus provides instructions that cerebellum uses to adjust muscle activity when learning new motor skills. Other nuclei coordinate vomiting, swallowing, sneezing, coughing, and hiccupping. Contains nuclei of origin for cranial nerves VIII, IX, X, XI, and XII. Reticular formation (also in pons, midbrain, and diencephalon) functions in consciousness and arousal.		Thalamus: Relays almost all sensory input to cerebral cortex. Contributes to motor functions by transmitting information from cerebellum and basal nuclei to primary motor area of cerebral cortex. Plays role in maintenance of consciousness. Hypothalamus: Controls and integrates activities of autonomic nervous system. Produces hormones, including releasing hormones, inhibiting hormones, oxytocin, and antidiuretic hormone (ADH). Regulates emotional and behavioral patterns (together with limbic system). Contains feeding and satiety centers (regulate eating), thirst center (regulates drinking), and suprachiasmatic nucleus (regulates circadian rhythms). Controls body temperature by serving as body's thermostat. Epithalamus: Consists of pineal gland (secretes melatonin) and habenular nuclei.
	Pons: Contains sensory and motor tracts. Pontine nuclei relay nerve impulses from motor areas of cerebral cortex to cerebellum. Contains vestibular nuclei (along with medulla) that are part of equilibrium pathway to brain. Pneumotaxic area and apneustic area (together with the medulla) help control breathing. Contains nuclei of origin for cranial nerves V, VI, VII, and VIII.		Sensory areas of cerebral cortex are involved in perception of sensory information; motor areas control execution of voluntary movements; association areas deal with more complex <u>integrative</u> functions such as memory, personality traits, and intelligence. Basal nuclei help initiate and terminate movements, suppress unwanted movements, and regulate muscle tone. Limbic system promotes range of emotions, including pleasure, pain, docility, affection, fear, and anger.
	Midbrain: Contains sensory and motor tracts. Superior colliculi coordinate movements of head, eyes, and trunk in response to visual stimuli. Inferior colliculi coordinate movements of head, eyes, and trunk in response to auditory stimuli. Substantia nigra and red nucleus contribute to control of movement. Contains nuclei of origin for cranial nerves III and IV.		
CEREBELLUM	Smooths and coordinates contractions of skeletal muscles. Regulates <u>posture</u> and balance. May have role in cognition and language processing.		

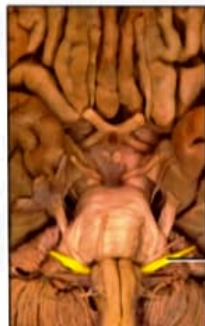
Figure 14.22 Vestibulocochlear (VIII) nerve.

 The vestibular branch of the vestibulocochlear nerve carries impulses for equilibrium, while the cochlear branch carries impulses for hearing.



CLINICAL CONNECTION | *Vertigo, Ataxia, and Nystagmus*

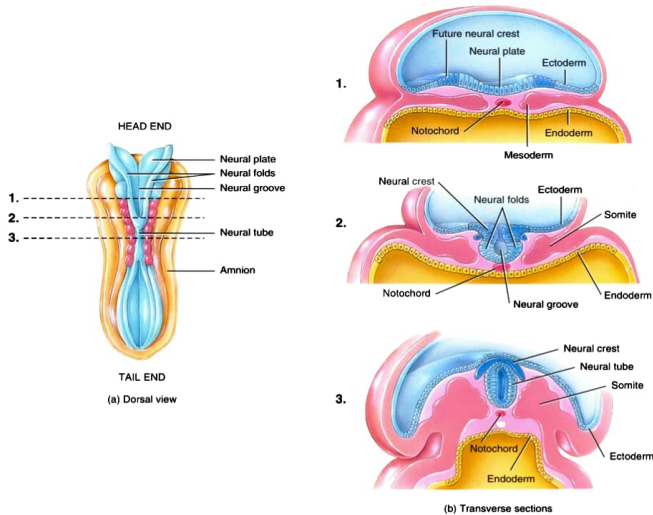
Injury to the vestibular branch of the vestibulocochlear (VIII) nerve may cause **vertigo** (ver-TI-gō) (a subjective feeling that one's own body or the environment is rotating), **ataxia** (a-TAK-sē-a) (muscular incoordination), and **nystagmus** (nis-TAG-mus) (involuntary rapid movement of the eyeball). Injury to the cochlear branch may cause **tinnitus** (ringing in the ears) or deafness. The vestibulocochlear nerve may be injured as a result of conditions such as trauma, **lesions**, or middle ear infections.



Vestibulocochlear (VIII) nerve

Figure 14.27 Origin of the nervous system. (a) Dorsal view of an embryo in which the neural folds have partially united, forming the early neural tube. (b) Transverse sections through the embryo showing the formation of the neural tube.

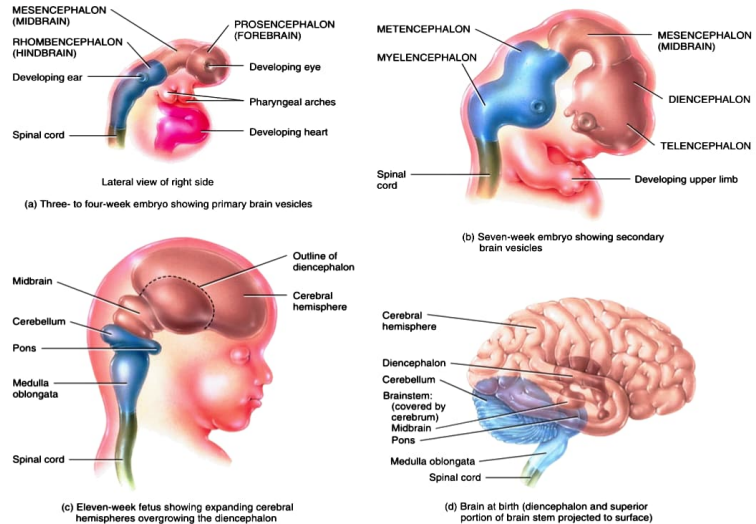
The nervous system begins developing in the third week from a thickening of ectoderm called the neural plate.



? What is the origin of the gray matter of the nervous system?

Figure 14.28 Development of the brain and spinal cord.

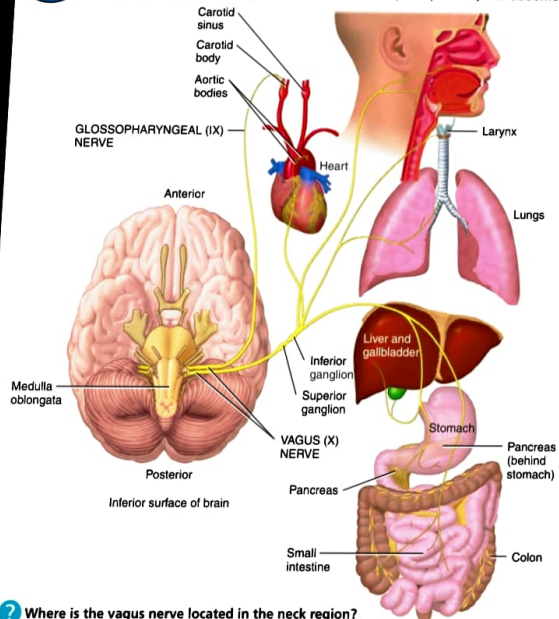
The various parts of the brain develop from the primary brain vesicles.



? Which primary brain vesicle does not develop into a secondary brain vesicle?

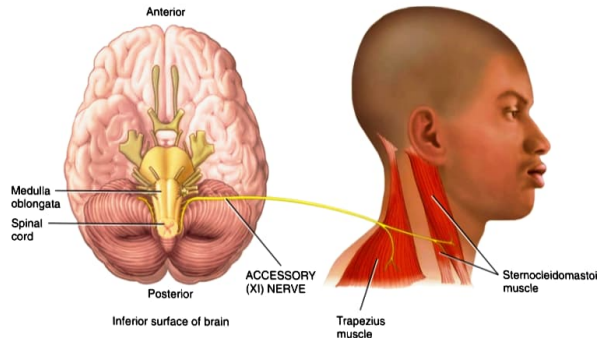
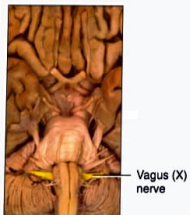
Figure 14.24 Vagus (X) nerve.

The vagus nerve is widely distributed in the head, neck, thorax, and abdomen.



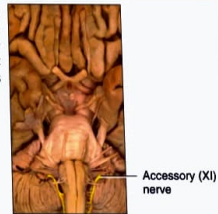
CLINICAL CONNECTION |
Vagal Paralysis, Dysphagia, and Tachycardia

Injury to the vagus (X) nerve due to conditions such as trauma or lesions causes **vagal paralysis**, or interruptions of sensations from many organs in the thoracic and abdominal cavities; **dysphagia** (dis-FĀ-gē-a), or difficulty in swallowing; and **tachycardia** (tak'-i-KAR-dē-a), or increased heart rate. •



CLINICAL CONNECTION |
Paralysis of the Sternocleidomastoid and Trapezius Muscles

If the accessory (XI) nerve is damaged due to conditions such as trauma, lesions, or stroke, the result is **paralysis of the sternocleidomastoid and trapezius muscles** so that the person is unable to raise the shoulders and has difficulty in turning the head. •



? How does the accessory nerve differ from the other cranial nerves?

? Where is the vagus nerve located in the neck region?

TABLE 14.3

Functional Differences between Right and Left Hemispheres

RIGHT HEMISPHERE FUNCTIONS

Receives somatic sensory signals from, and controls muscles on, left side of body.

Musical and artistic awareness.

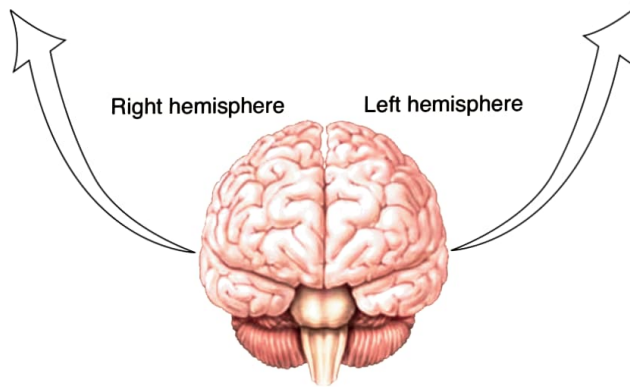
Space and pattern perception.

Recognition of faces and emotional content of facial expressions.

Generating emotional content of language.

Generating mental images to compare spatial relationships.

Identifying and discriminating among odors.



LEFT HEMISPHERE FUNCTIONS

Receives somatic sensory signals from, and controls muscles on, right side of body.

Reasoning.

Numerical and scientific skills.

Ability to use and understand sign language.

Spoken and written language.

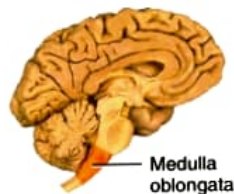
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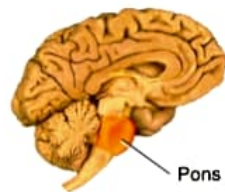
FUNCTION

BRAIN STEM



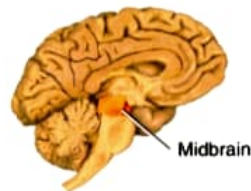
Medulla oblongata

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Pons

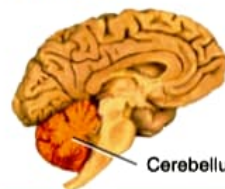
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Midbrain

Midbrain: Contains sensory and motor tracts. Superior colliculi coordinate movements of head, eyes, and trunk in response to visual stimuli. Inferior colliculi coordinate movements of head, eyes, and trunk in response to auditory stimuli. Substantia nigra and red nucleus contribute to control of movement. Contains nuclei of origin for cranial nerves III and IV.

CEREBELLUM



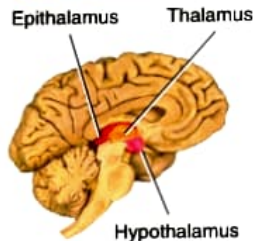
Cerebellum

Smooths and coordinates contractions of skeletal muscles. Regulates posture and balance. May have role in cognition and language processing.

PART

FUNCTION

DIENCEPHALON



Epithalamus

Thalamus

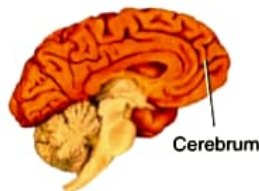
Hypothalamus

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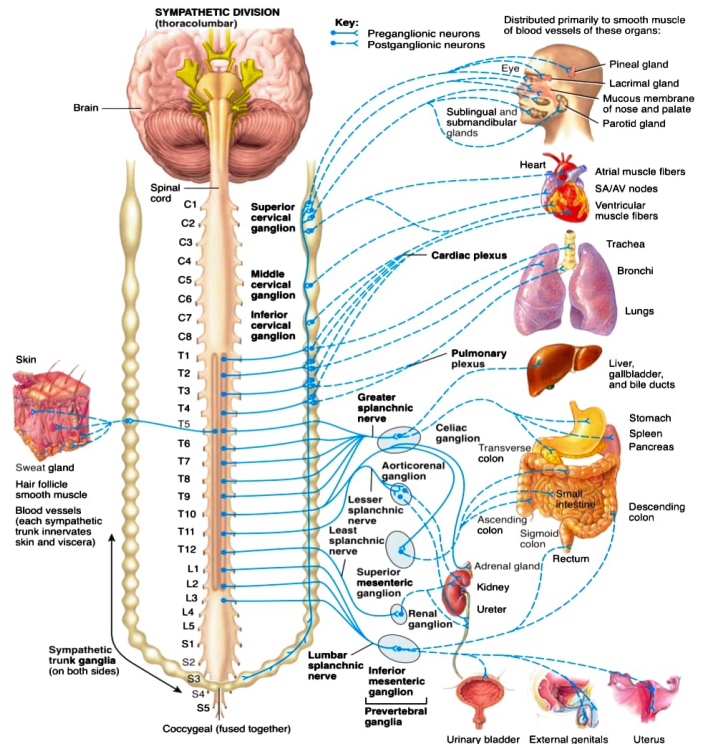
CEREBRUM



Cerebrum

Sensory areas of cerebral cortex are involved in perception of sensory information; motor areas control execution of voluntary movements; association areas deal with more complex integrative functions such as memory, personality traits, and intelligence. Basal nuclei help initiate and terminate movements, suppress unwanted movements, and regulate muscle tone. Limbic system promotes range of emotions, including pleasure, pain, docility, affection, fear, and anger.

Cell bodies of sympathetic preganglionic neurons are located in the lateral horns of gray matter in the 12 thoracic and first two lumbar segments of the spinal cord.



Cell bodies of parasympathetic preganglionic neurons are located in brain stem nuclei in the second through fourth sacral segments of the spinal cord.

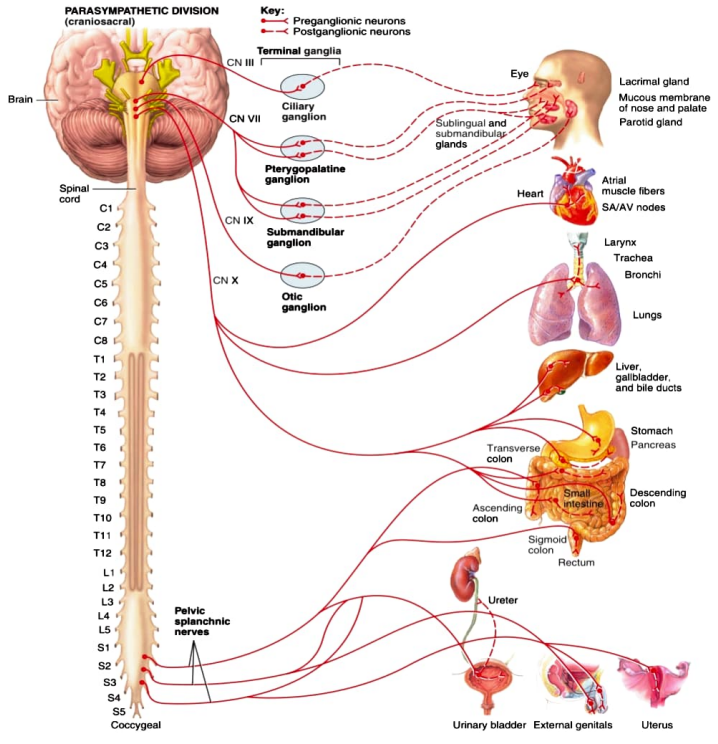
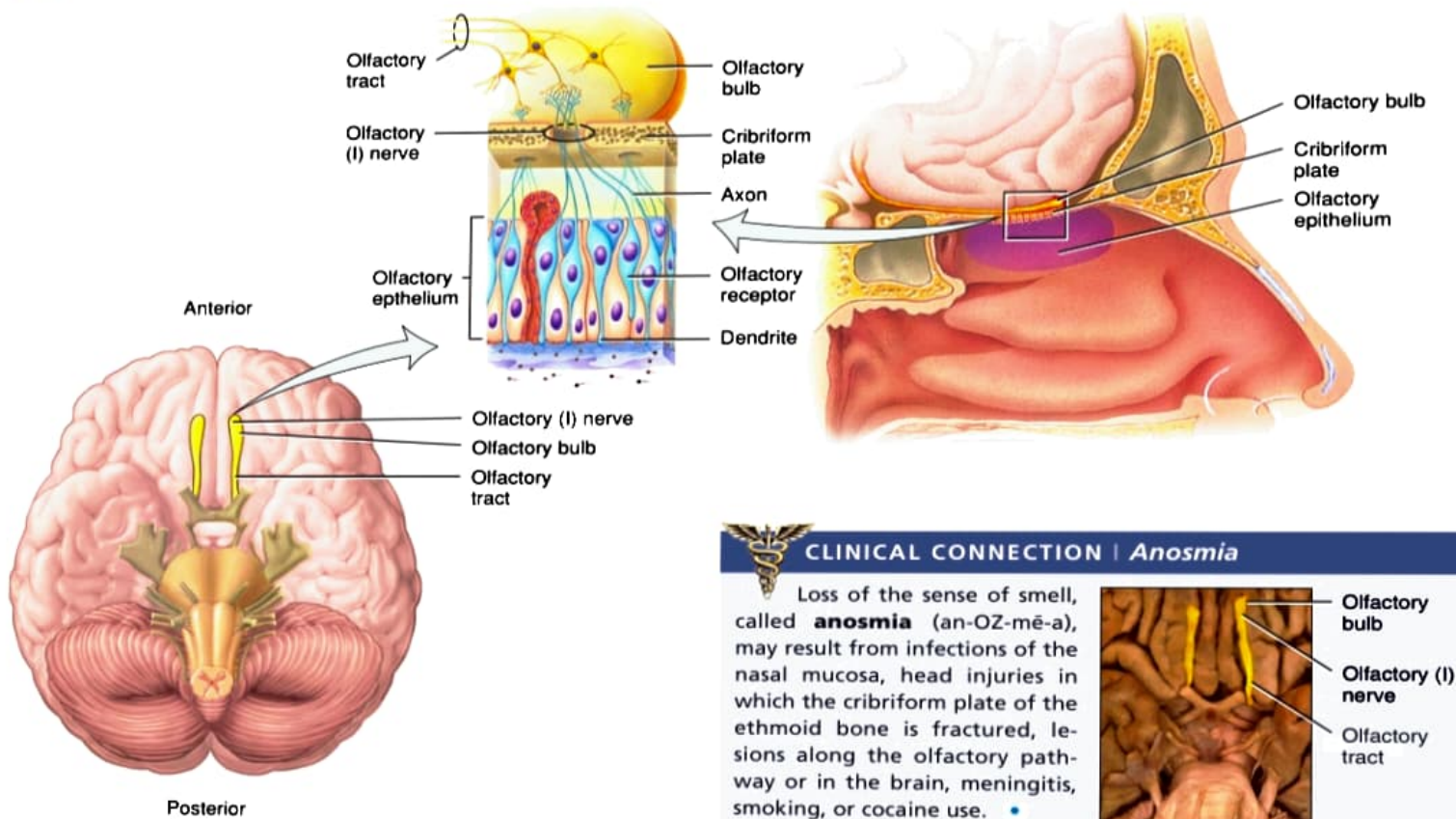


Figure 14.17 Olfactory (I) nerve.

The olfactory epithelium is located on the inferior surface of the cribriform plate and superior nasal conchae.



CLINICAL CONNECTION | Anosmia

Loss of the sense of smell, called **anosmia** (an-OZ-mē-a), may result from infections of the nasal mucosa, head injuries in which the cribriform plate of the ethmoid bone is fractured, lesions along the olfactory pathway or in the brain, meningitis, smoking, or cocaine use.

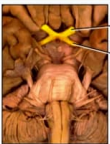
? Where do axons in the olfactory tracts terminate?

Figure 14.18 Optic (II) nerve.

In sequence, visual signals are relayed from rods and cones to bipolar cells to ganglion cells.

CLINICAL CONNECTION | Anopia

Fractures in the orbit, brain lesions, damage along the visual pathway, diseases of the nervous system (such as multiple sclerosis), pituitary gland tumors, or cerebral aneurysms (enlargements of blood vessels due to weakening of their walls) may result in visual field defects and loss of visual acuity. Blindness due to a defect in or loss of one or both eyes is called **anopia** (an-Ō-pē-a).



Optic (II) nerve
Optic tract

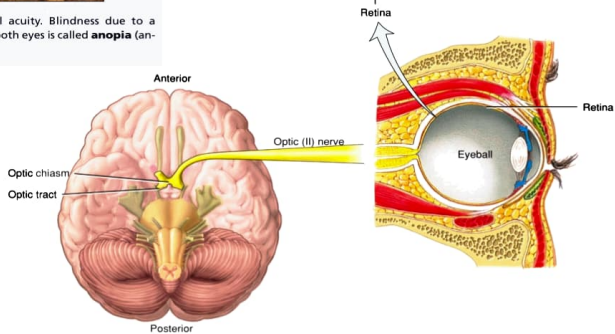
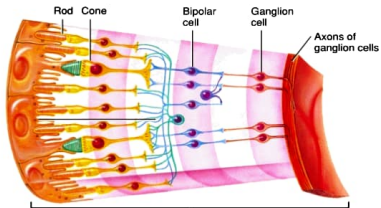
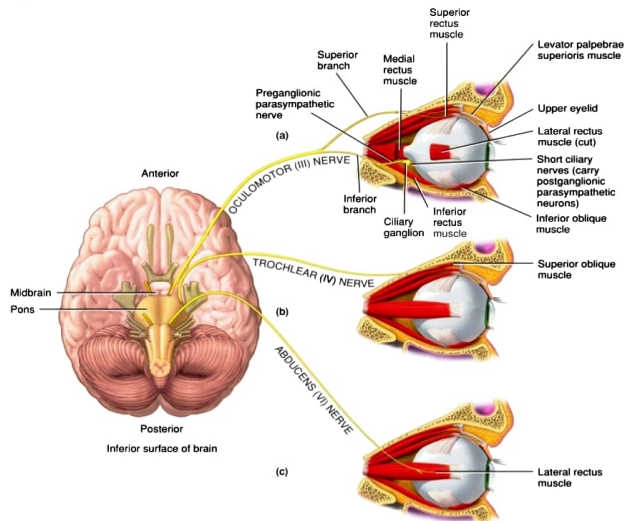


Figure 14.19 Oculomotor (III), trochlear (IV), and abducens (VI) nerves.

The oculomotor nerve has the widest distribution among extrinsic eye muscles.



Which branch of the oculomotor nerve is distributed to the superior rectus muscle? Which is the smallest cranial nerve?

Where do most axons in the optic tracts terminate?