Cranial Nerves

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Sensory and Motor Systems

Sensory Systems:

- Somatosensory
- Visceral sensory
- Special sensory
  - Vision
  - Auditory
  - Vestibular
  - Gustatory (taste)
  - Olfactory (smell)

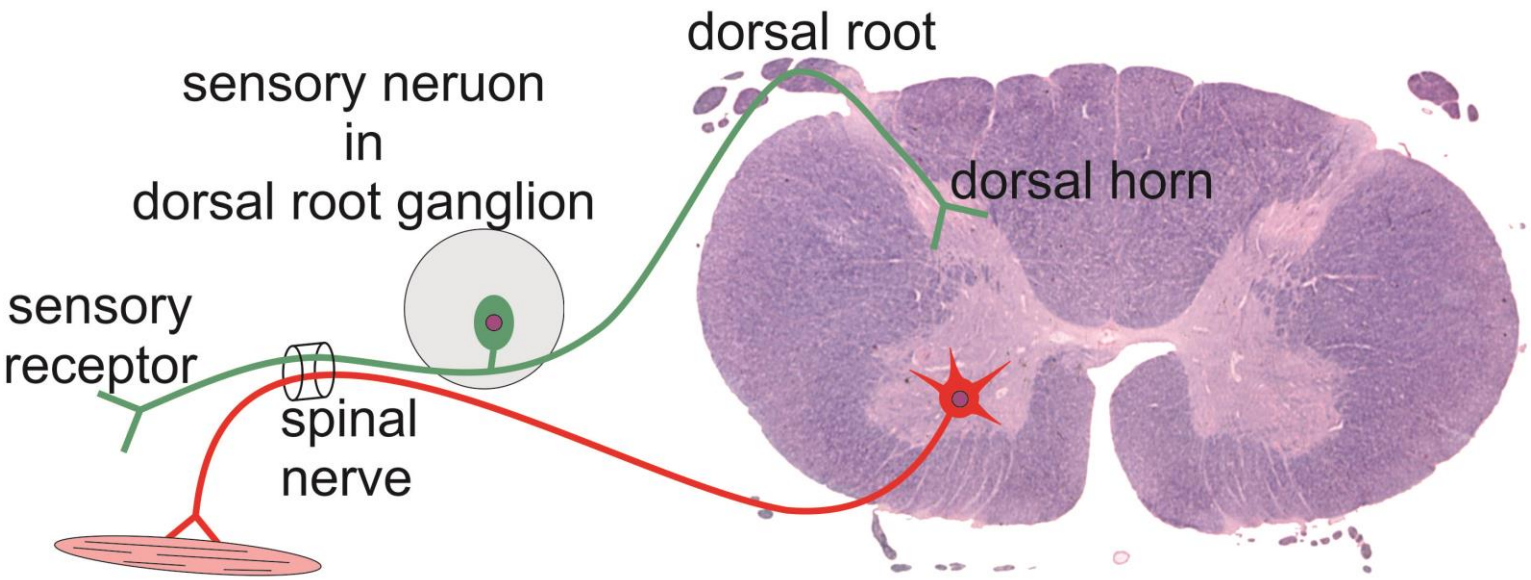
> general sensory

Motor Systems:

- Somatomotor
- Branchial motor
- Autonomic (visceral) motor
  - Parasympathetic
  - Sympathetic

> general motor

General Sensory and General Motor Systems

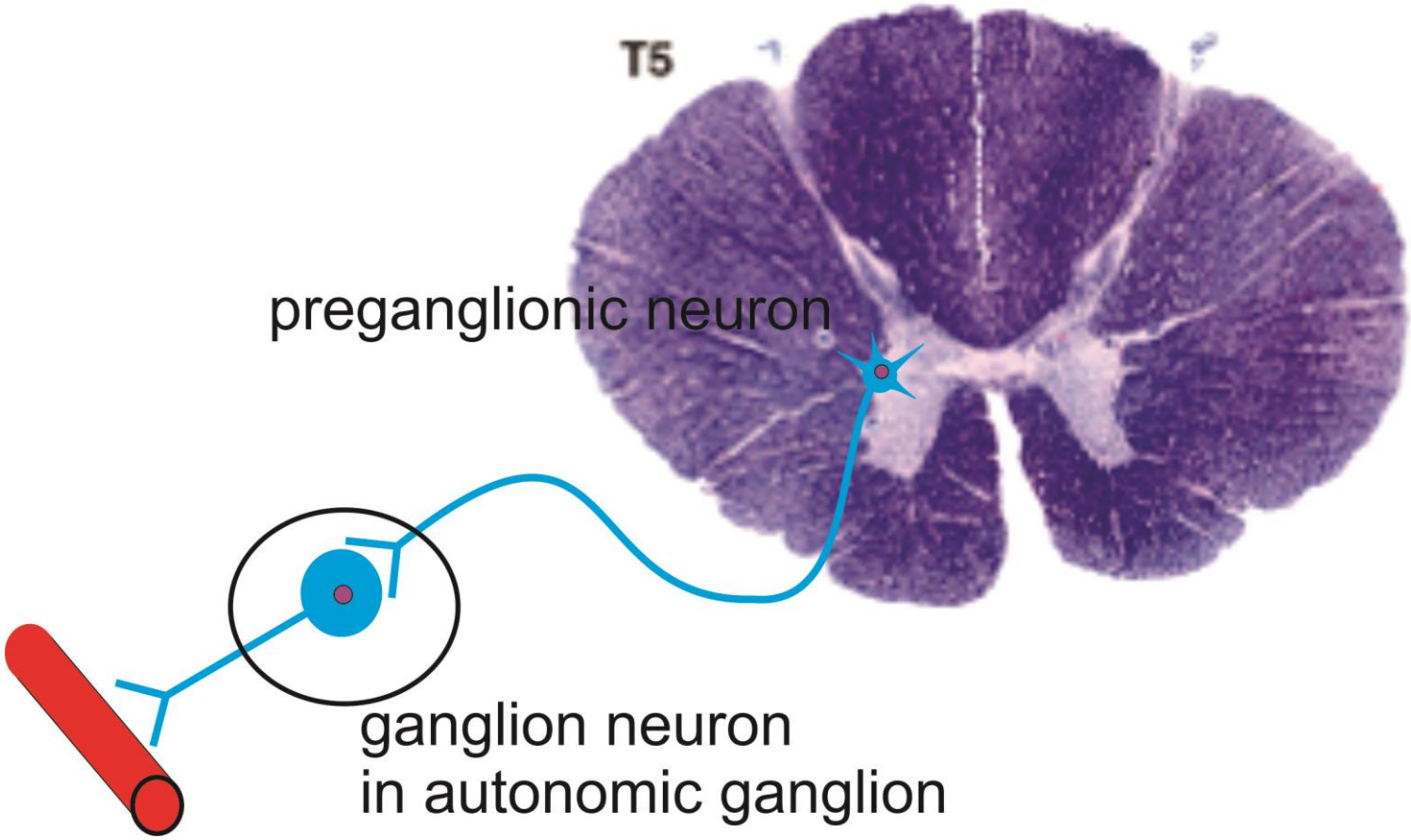


Autonomic Motor System

- The autonomic motor system controls smooth muscle, the heart, glands, blood vessels, etc.

Autonomic Motor System

- It is a two neuron output system, a preganglionic neuron in the brainstem or spinal cord and a ganglion neuron in a ganglion.



Autonomic Motor System

The autonomic system has two subdivisions:

- Sympathetic system
  - Preganglionic neurons are in the thoracic spinal cord.
  - Ganglion neurons are in sympathetic ganglia on both sides of the vertebral column.
  - Preganglionic axons are short and postganglionic axons are long.

- Parasympathetic system
  - Preganglionic neurons are in the brainstem and sacral spinal cord.
  - Ganglion neurons are in parasympathetic ganglia near their targets.
  - Preganglionic axons are long and postganglionic axons are short.

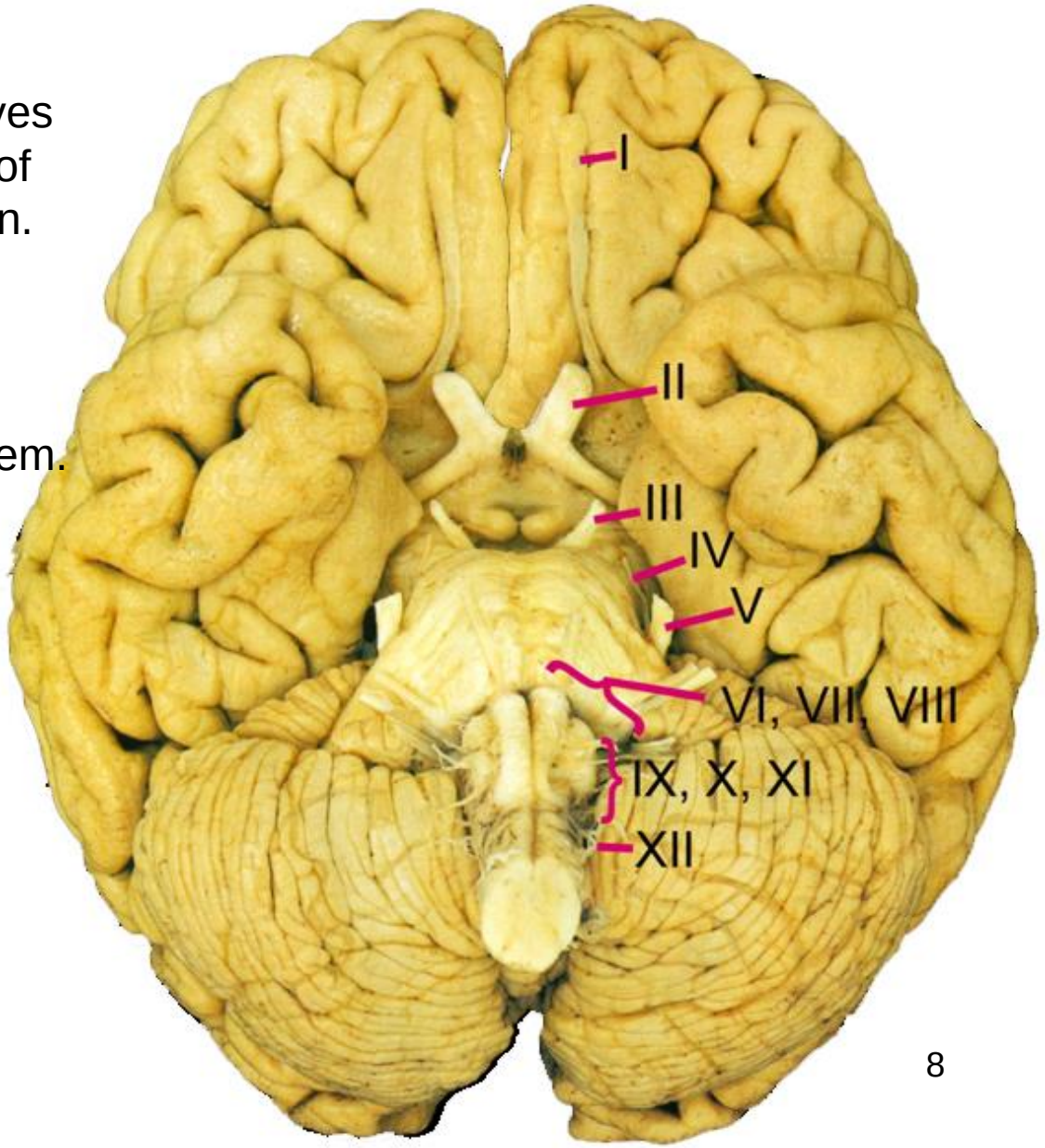
Special Sensory Systems

- The circuitry of each is unique and does not lend itself to a general diagram.

- All use cranial nerves (and not spinal nerves) to relay information into the brain.

Twelve Pairs of Cranial Nerves

- The 12 pairs of cranial nerves are numbered in the order of their attachment to the brain.
- The first two cranial nerves attach to the forebrain; the others attach to the brainstem.



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cranial nerve		*function*				
		general motor	*parasympathetic*	*general sensory*	*special sensory*	
I	Olfactory				X (olfaction)	
II	Optic				X (vision)	
III	Oculomotor	X[a]	X			
IV	Trochlear	X[a]				
V	Trigeminal	X[b]		X[c]		
VI	Abducens	X[a]				
VII	Facial	X[b]	X	X	X (taste)	
VIII	Vestibulocochlear				X (auditory & vestibular)	
IX	Glossopharyngeal	X[b]	X	X[c]	X (taste)	
X	Vagus	X[b]	X	X[c]	X (taste)	
XI	Accessory *	X[a]				
XII	Hypoglossal	X[a]				

* cervical component; cranial component included with vagus

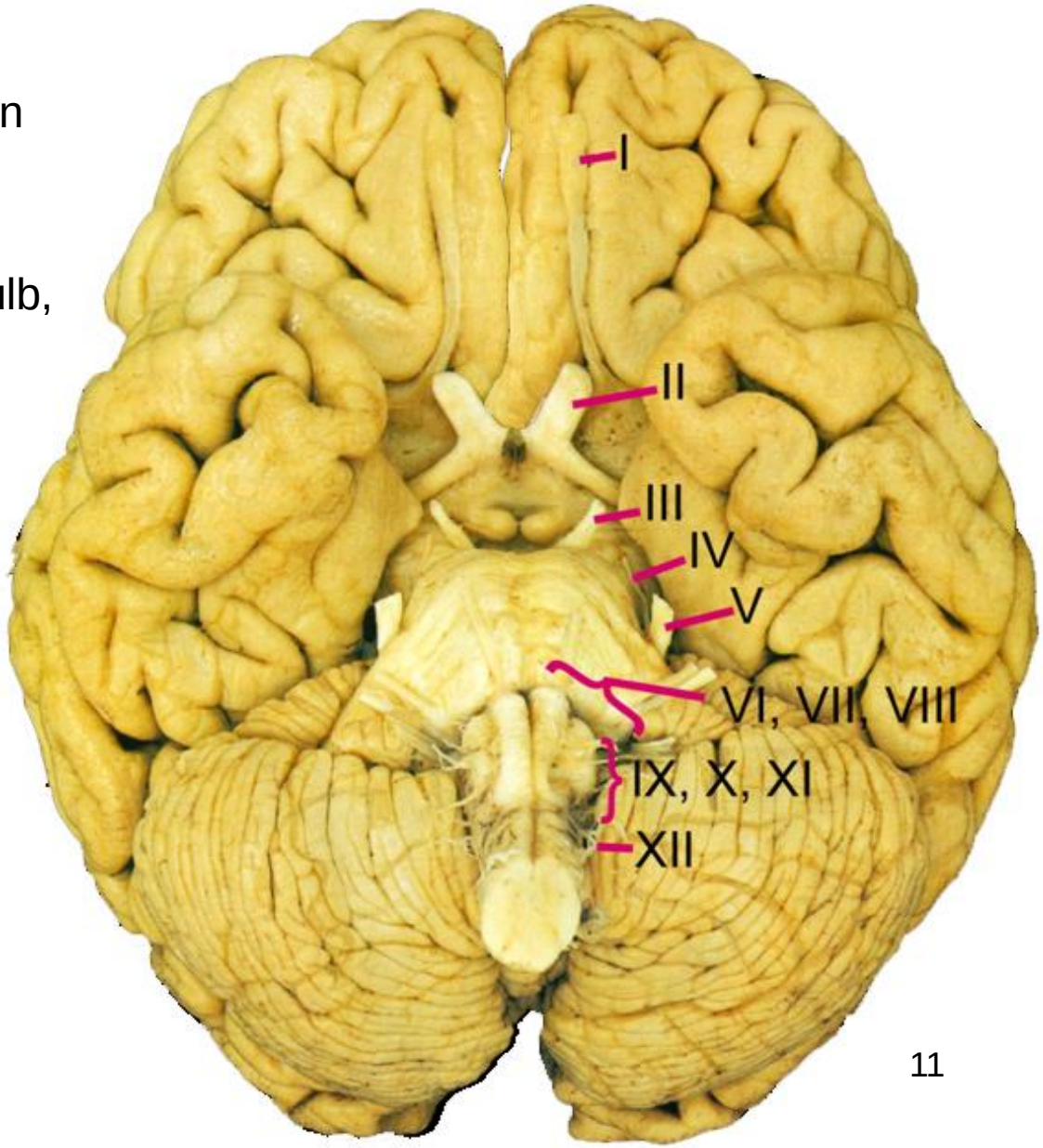
[a] somatic motor – innervates muscles that develop from somites

[b] branchial motor – innervates muscles that develop from pharyngeal (branchial) arches

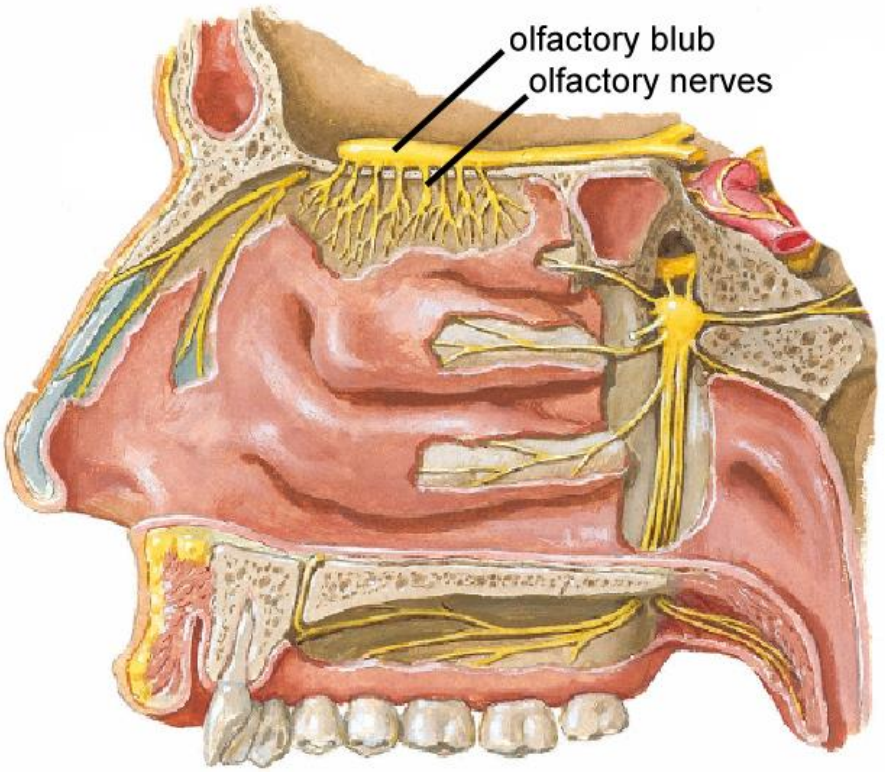
[c] includes visceral sensory as well as somatosensory

Olfactory Nerve (CN I)

- Special sensory for olfaction (sense of smell)
- Attaches to the olfactory bulb, part of the forebrain

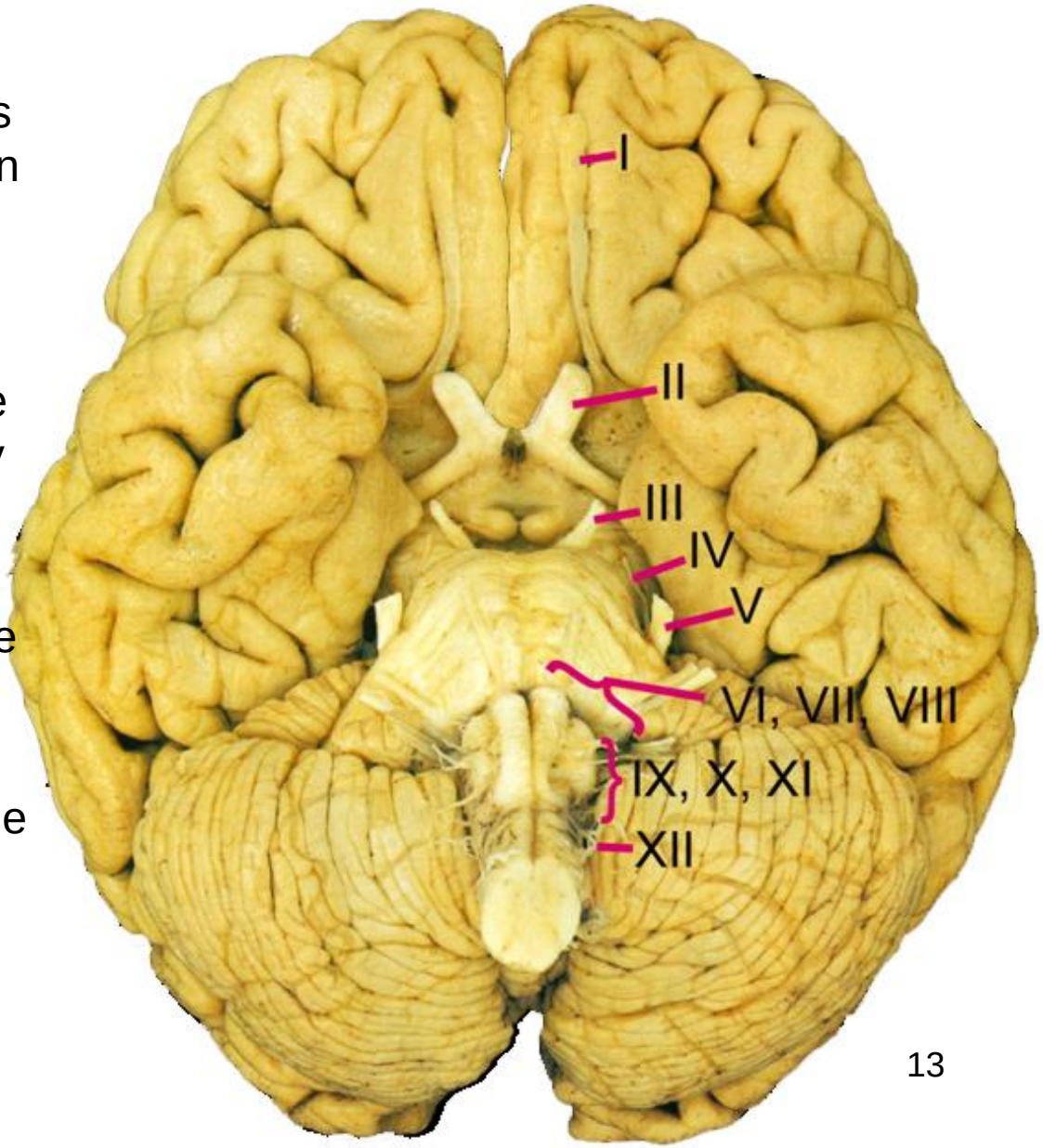


Olfactory Nerve (CN I)



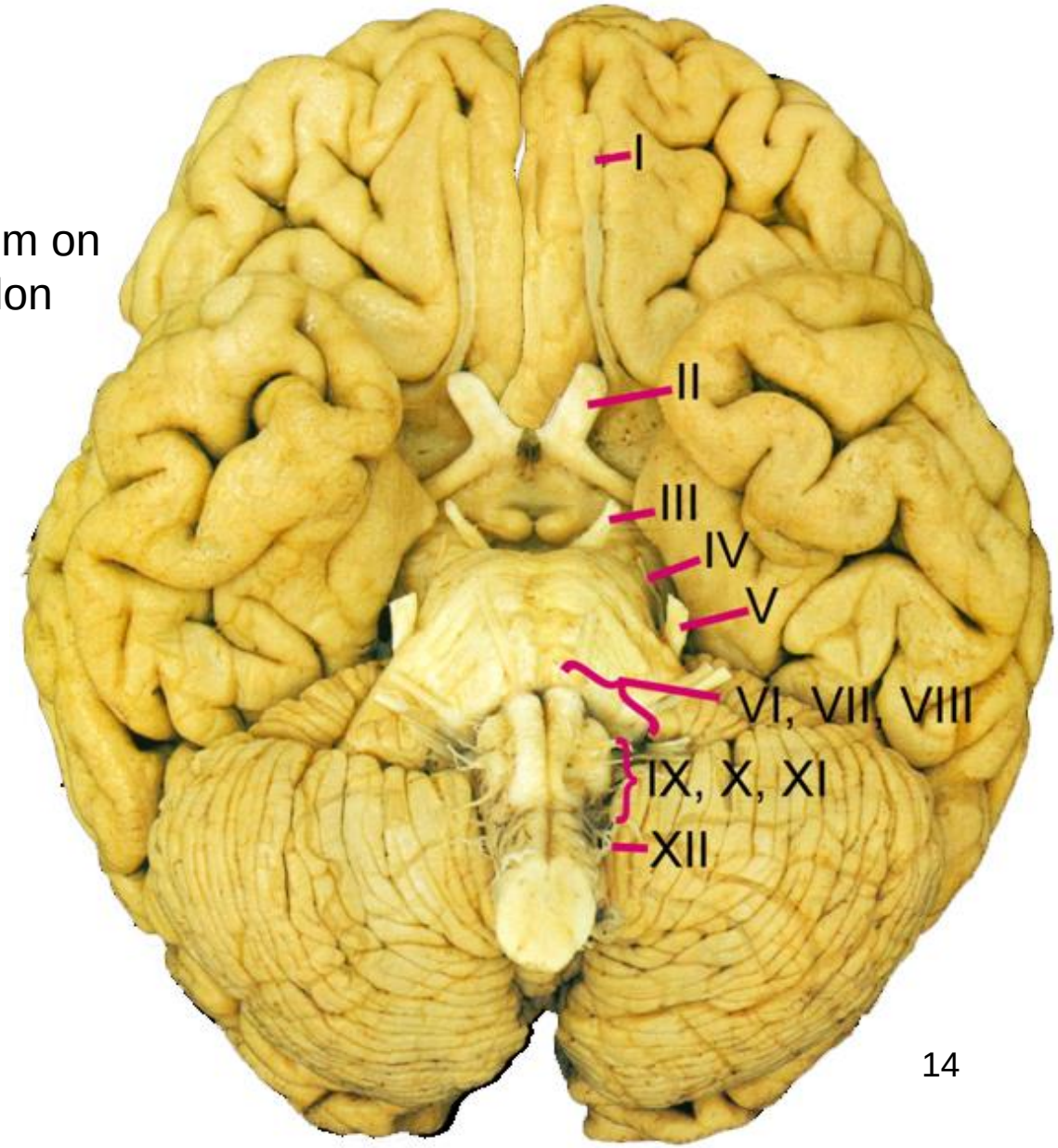
Olfactory Nerve (CN I)

- Olfactory nerves are the axons of olfactory receptor neurons in the wall of the nasal cavity.
- The nerves pass through the bone into the cranium, and the axons synapse in the olfactory bulb.
- The olfactory bulb is part of the brain.
- The olfactory tract connects the bulb to the cortex.



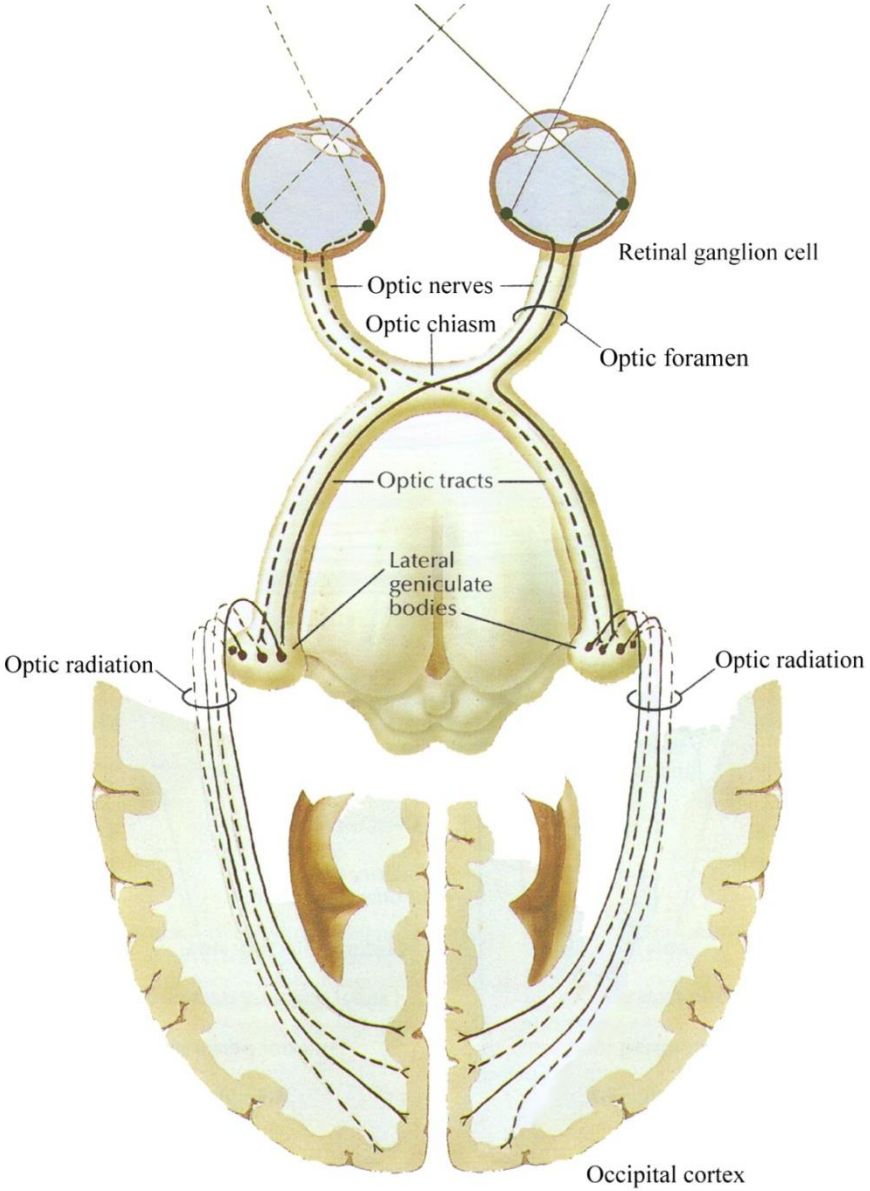
Optic Nerve (CN II)

- Special sensory for vision
- Attaches to the optic chiasm on the base of the diencephalon



Optic Nerve (CN II)

- Optic nerves are the axons of retinal ganglion cells inside the eye.
- The optic nerve is really a tract (CNS).
- The axons continue via the optic chiasm and then optic tract to various visual centers in the brain, including:
  - Lateral geniculate nucleus (thalamus)
  - Superior colliculus (midbrain)

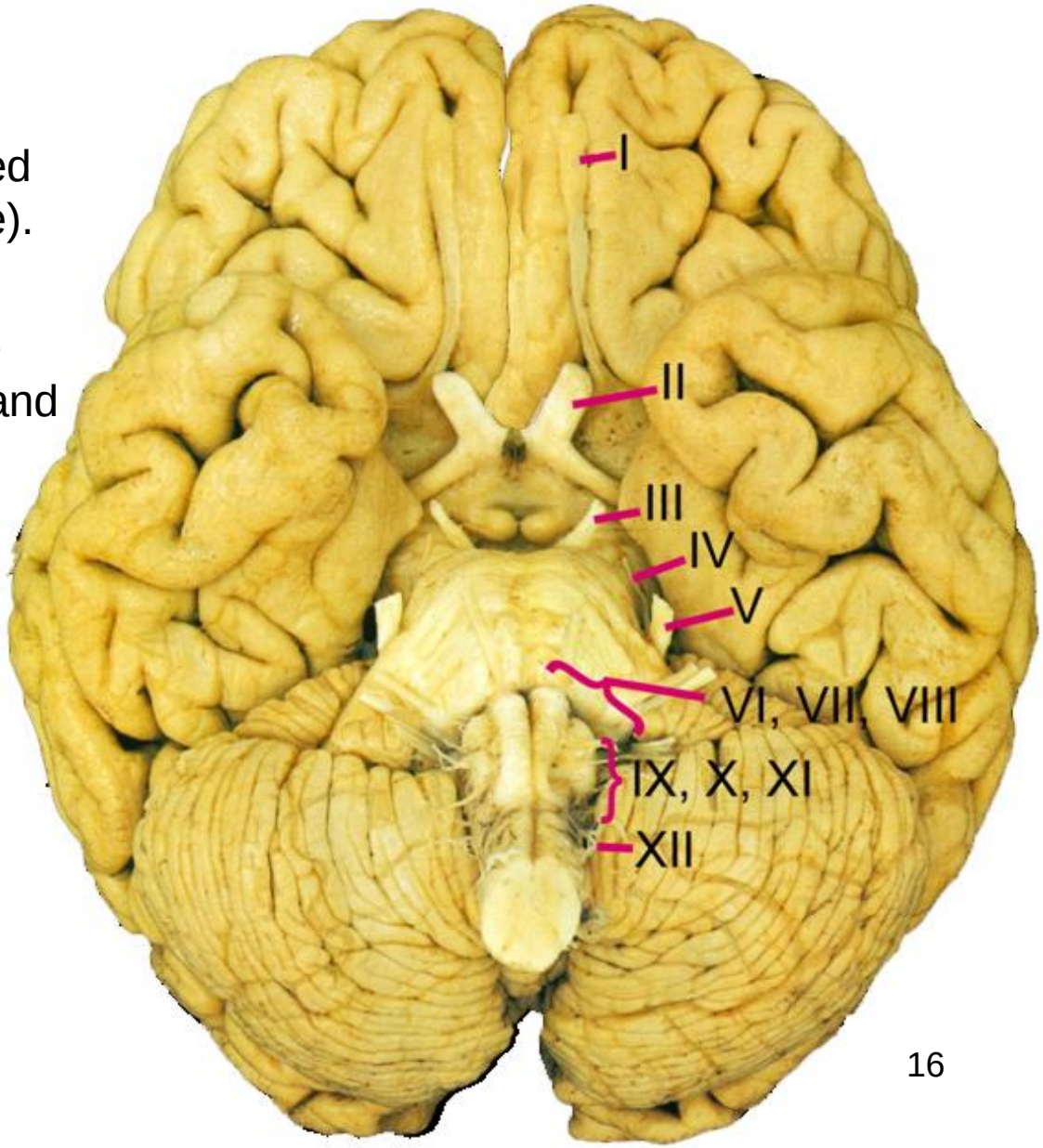


Oculomotor Nerve (CN III)

- General motor to extraocular muscles (the muscles attached to the eye that direct the gaze).

  Parasympathetic motor to the muscle for focusing the lens and to the iris for regulating how much light gets into the eye

- Attaches to the midbrain between cerebral peduncles

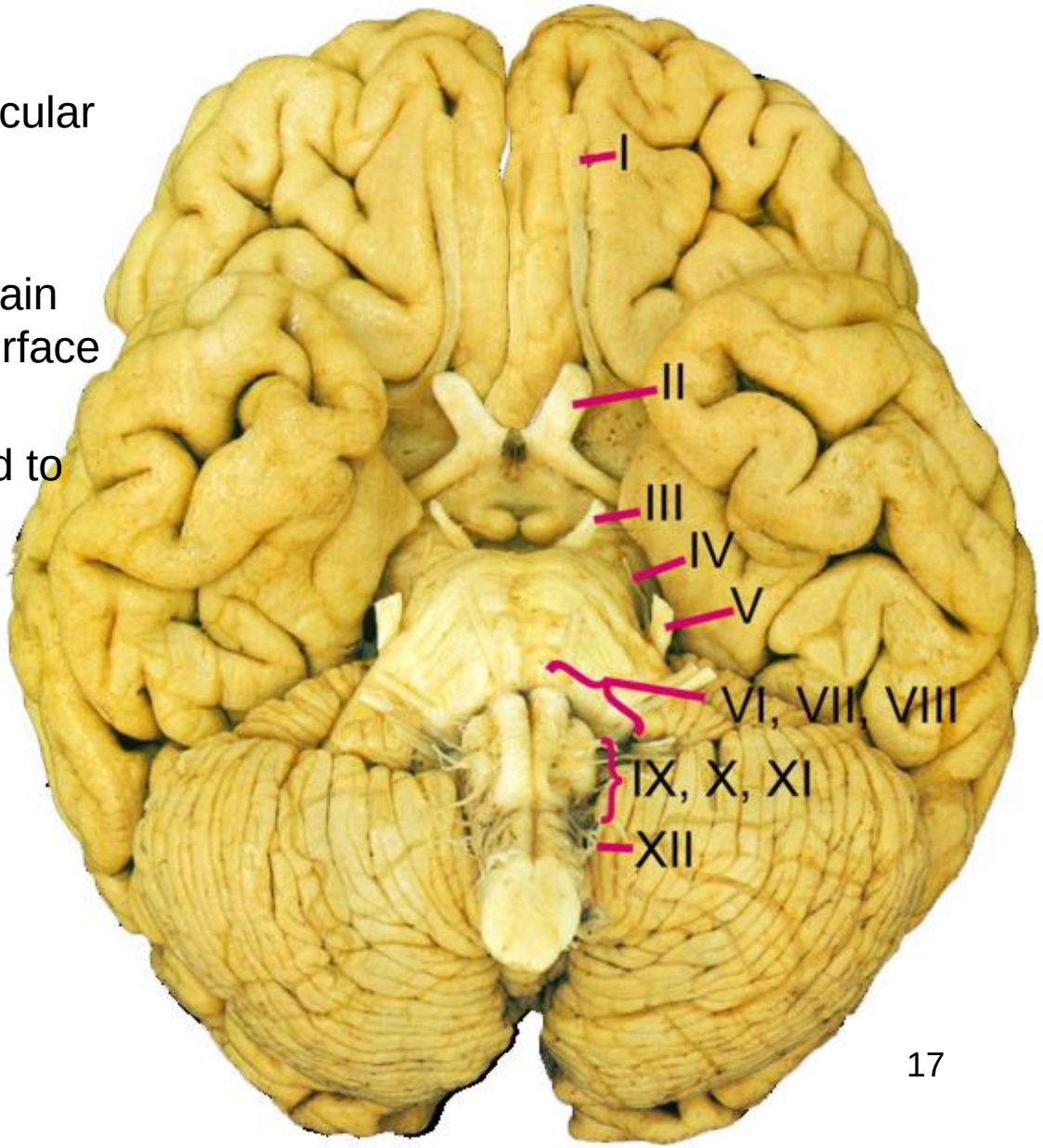


Trochlear Nerve (CN IV)

- General motor to an extraocular muscle

- Attaches to the pons-midbrain junction on the posterior surface of the brainstem

  (only cranial nerve attached to the dorsal surface)



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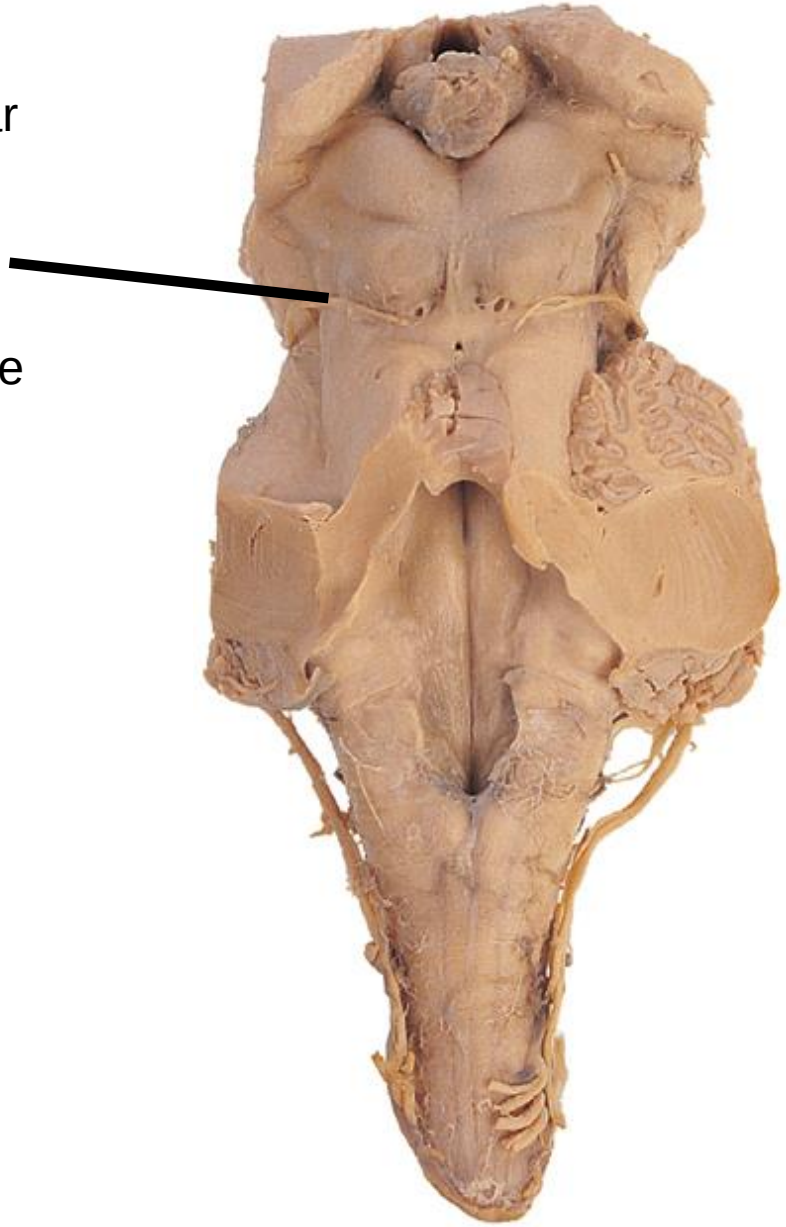
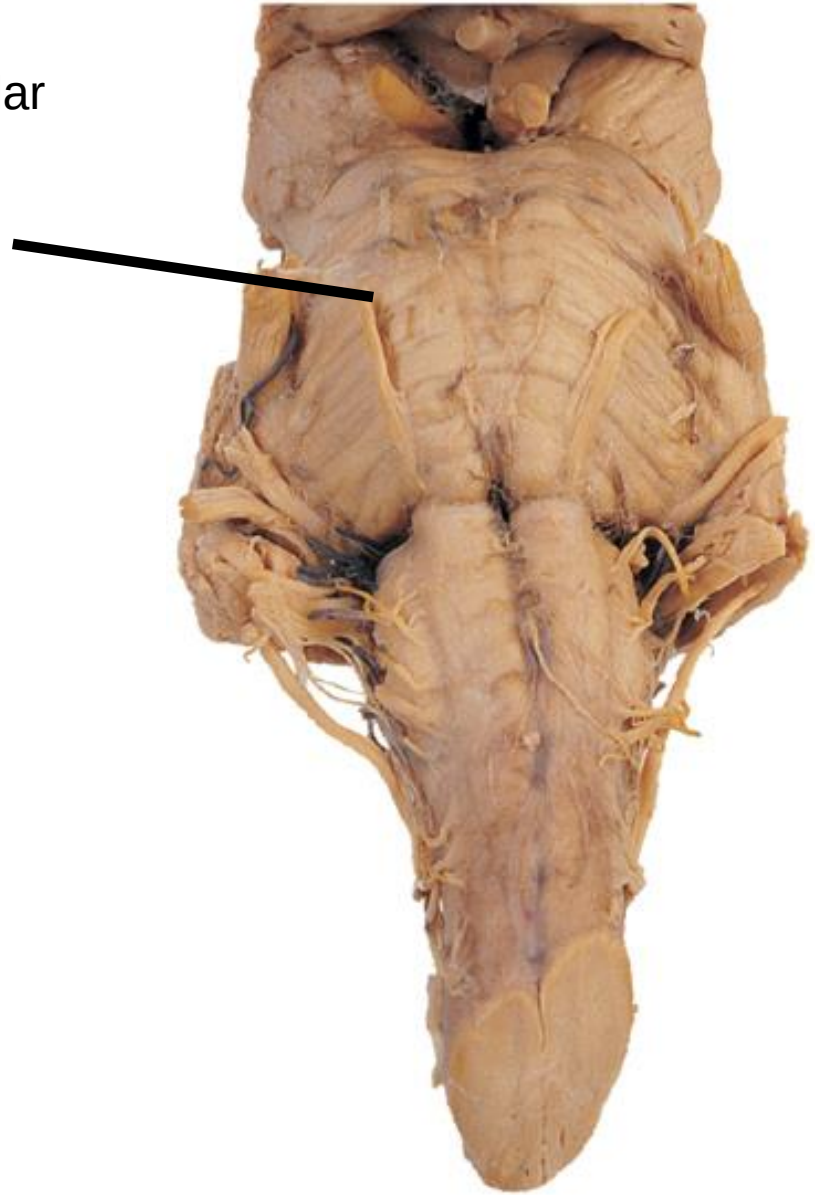
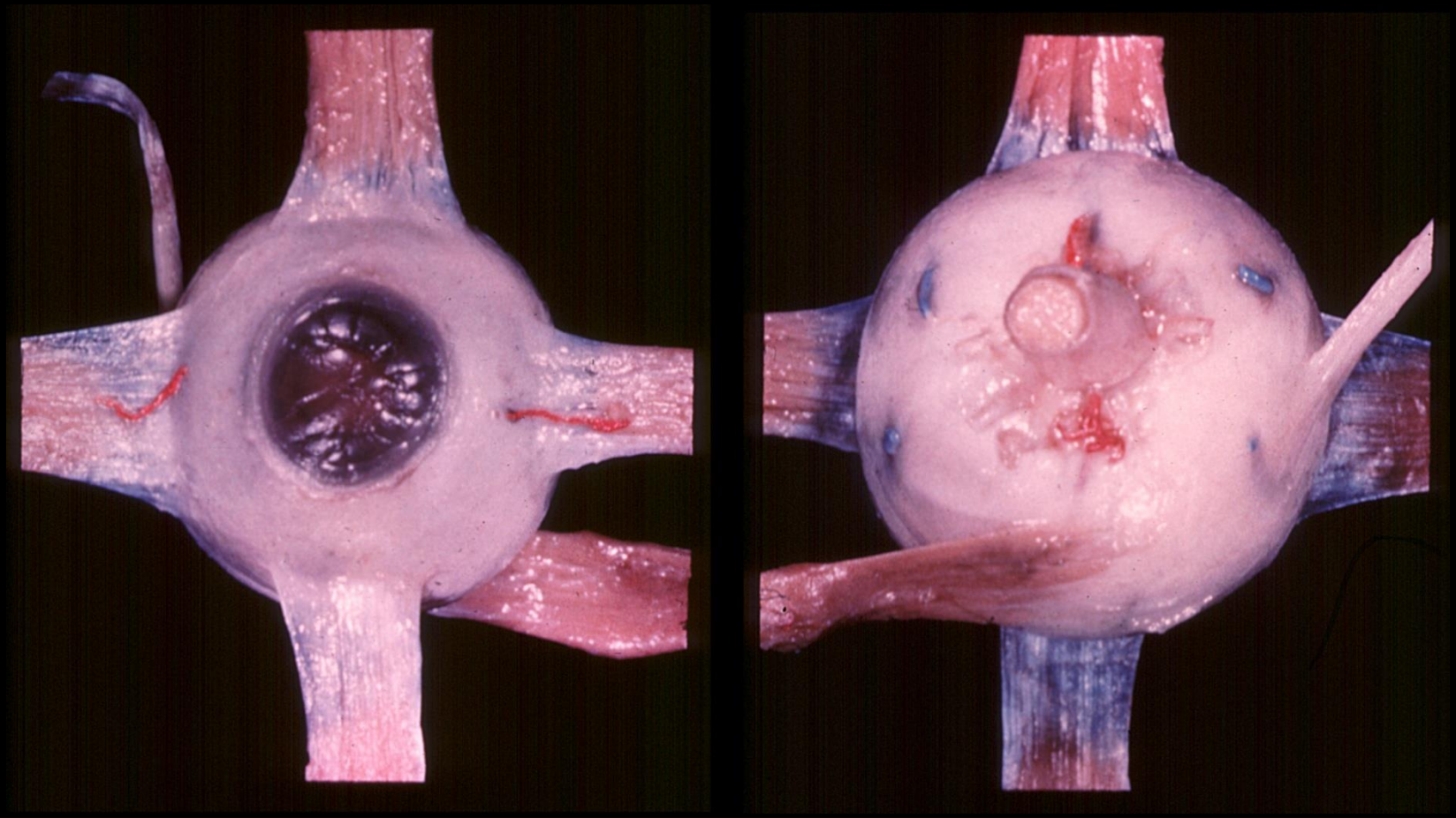


Abducens Nerve (CN VI)

- General motor to an extraocular muscle
- Attaches to the medulla-pons junction

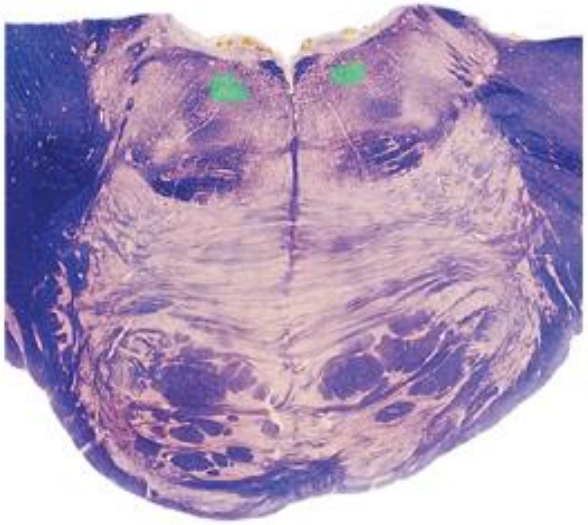


Oculomotor (CN III), Trochlear (CN IV) and Abducens (CN VI) Nerves



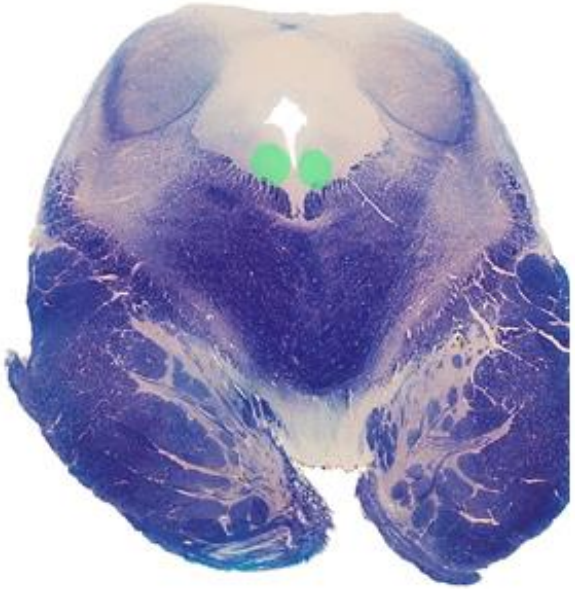
Oculomotor (CN III), Trochlear (CN IV) and Abducens (CN VI) Nerves

Abducens Nuc.



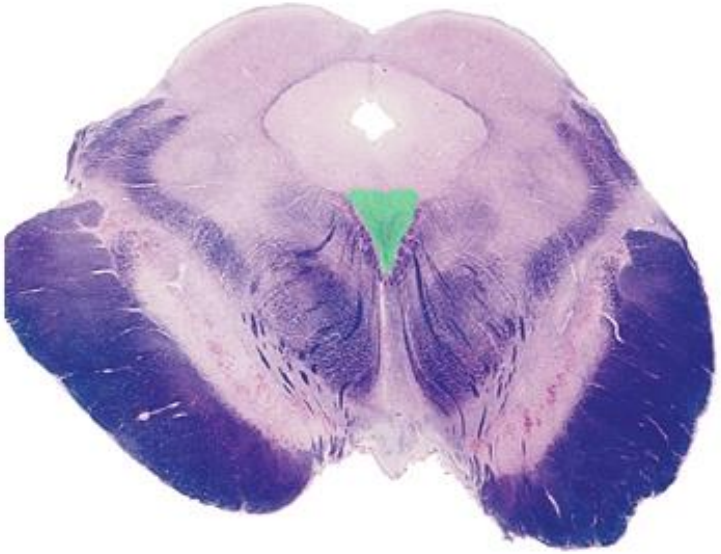
pons

Trochlear Nuc.



lower midbrain

Oculomotor Nuc.



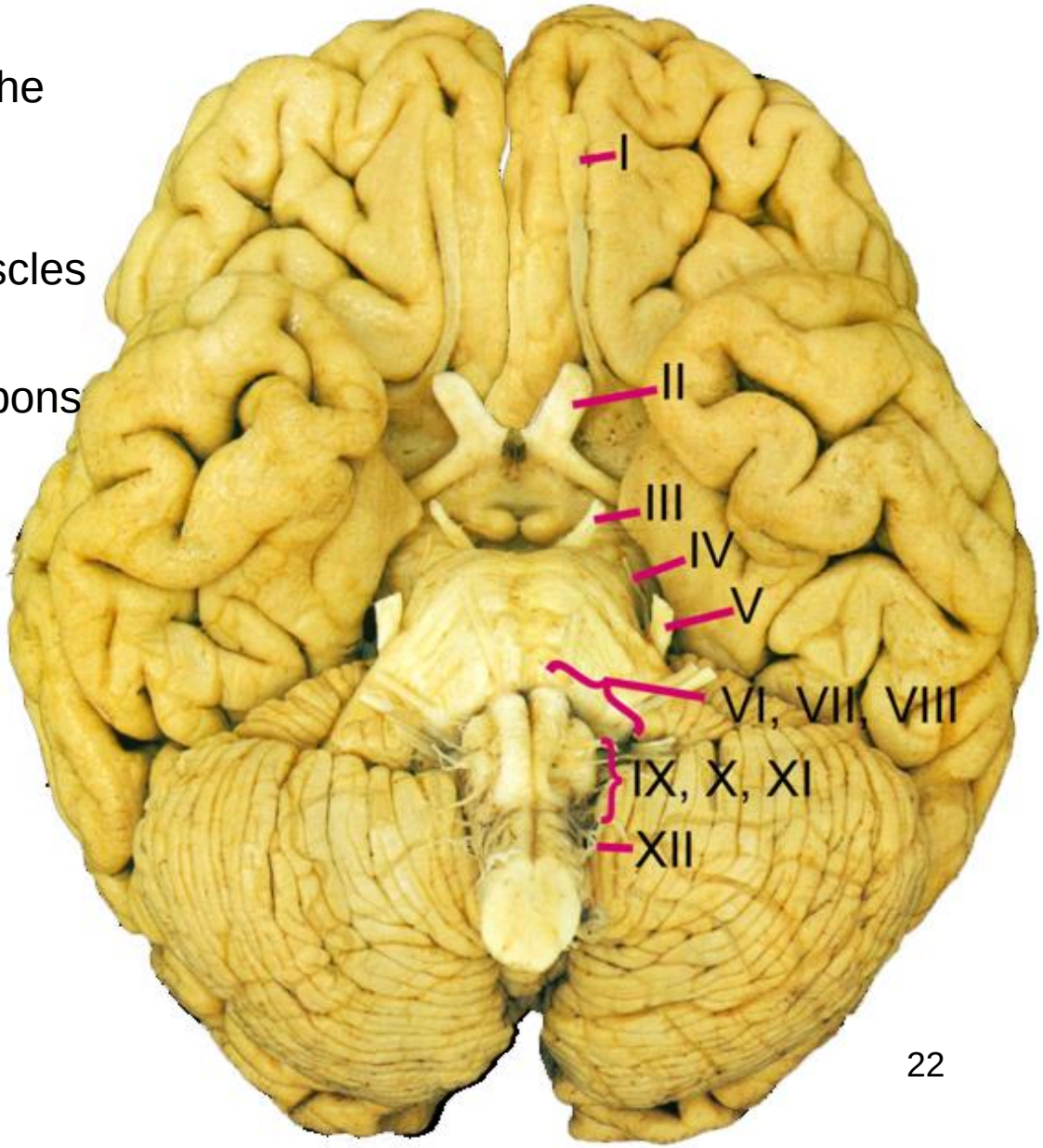
upper midbrain

Trigeminal Nerve (CN V)

- General sensory for much of the head

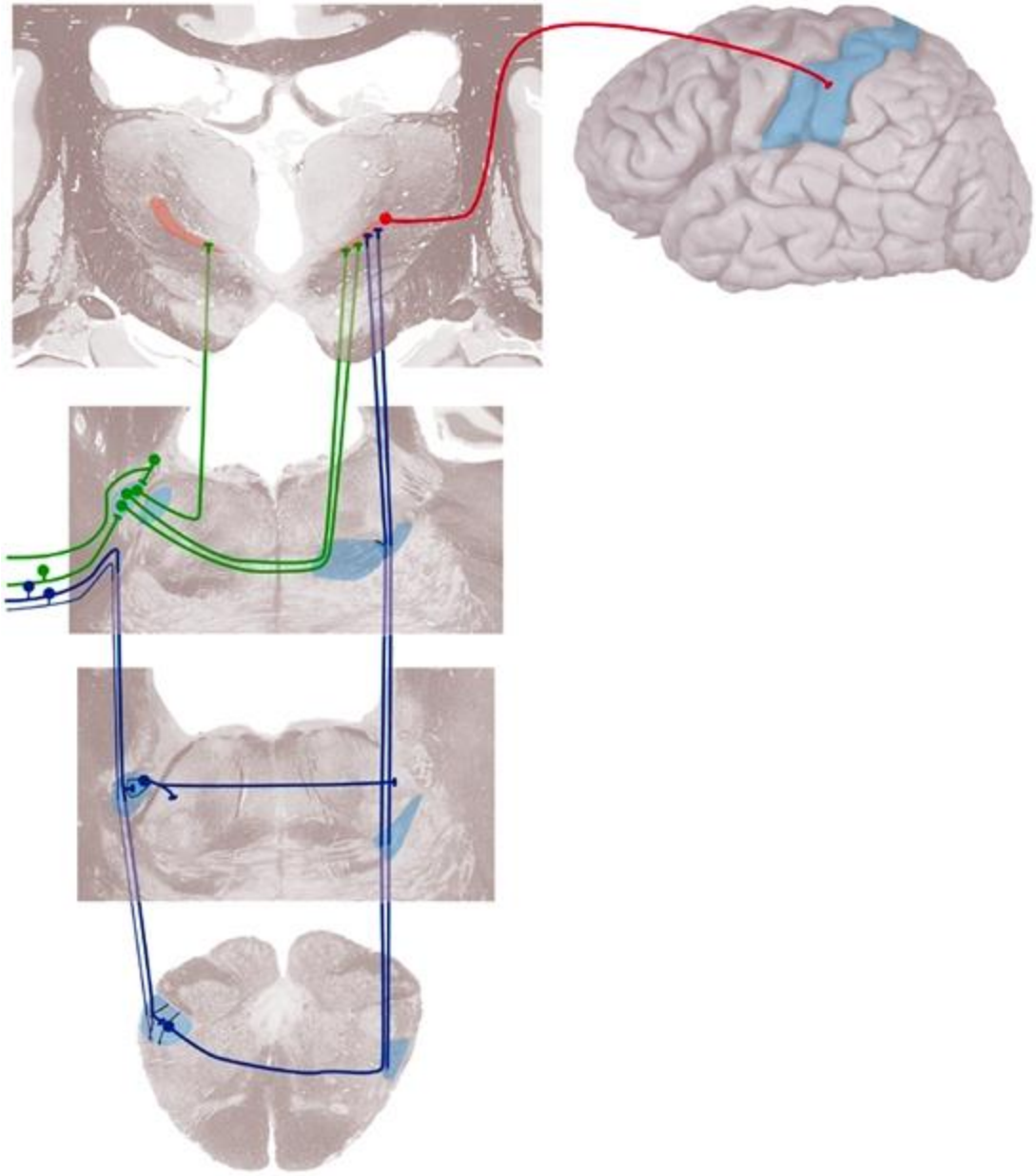
  General motor for the jaw muscles

- Attaches to the middle of the pons



Trigeminal Nerve (CN V)

- Trigeminal sensory pathways in the brain are similar to that for the rest of the body.



Facial Nerve (CN VII)

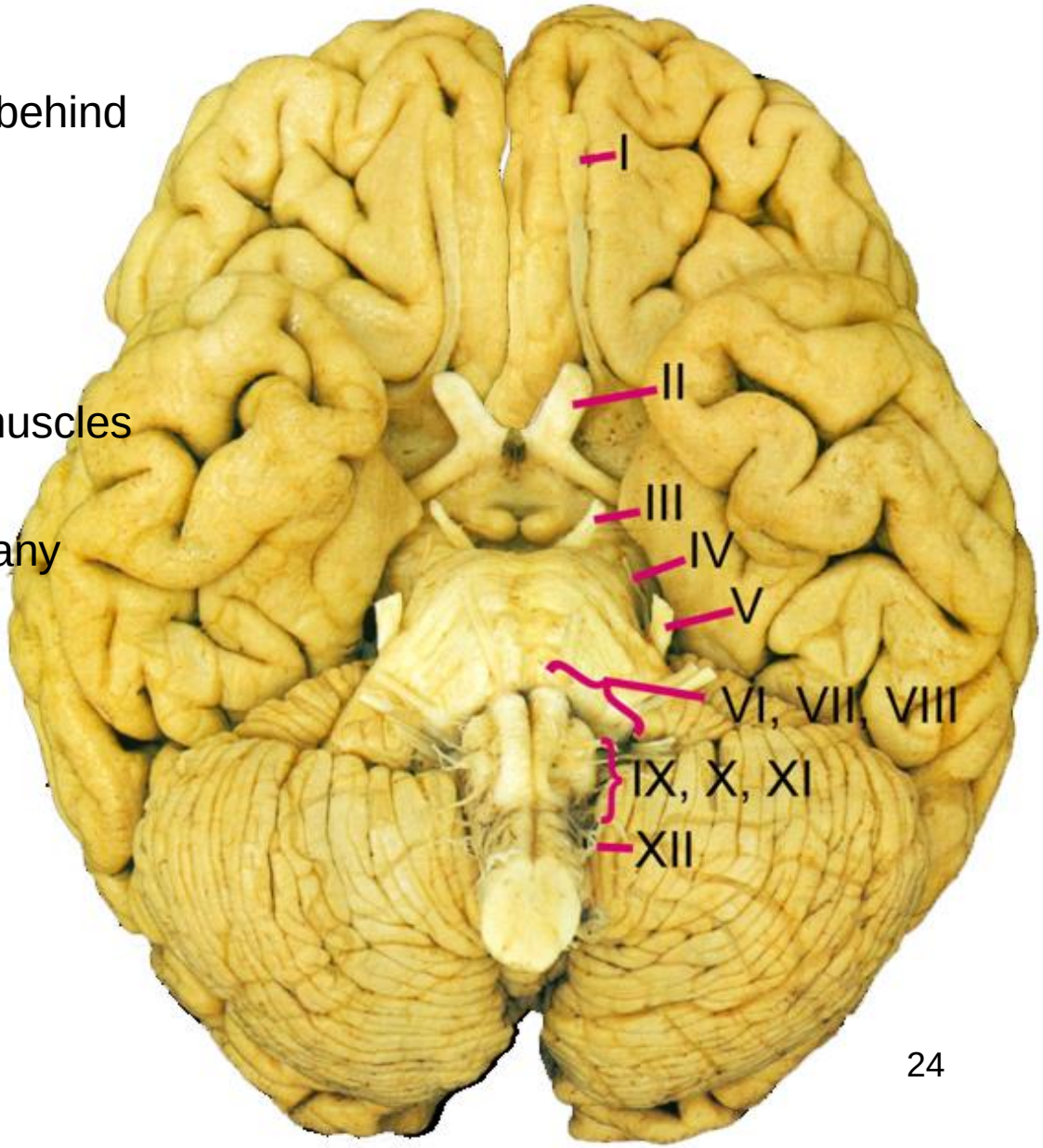
- General sensory for skin just behind the ear

  Special sensory for taste

  General motor for the facial muscles

  Parasympathetic motor for many glands in the head

- Attaches to the medulla-pons junction



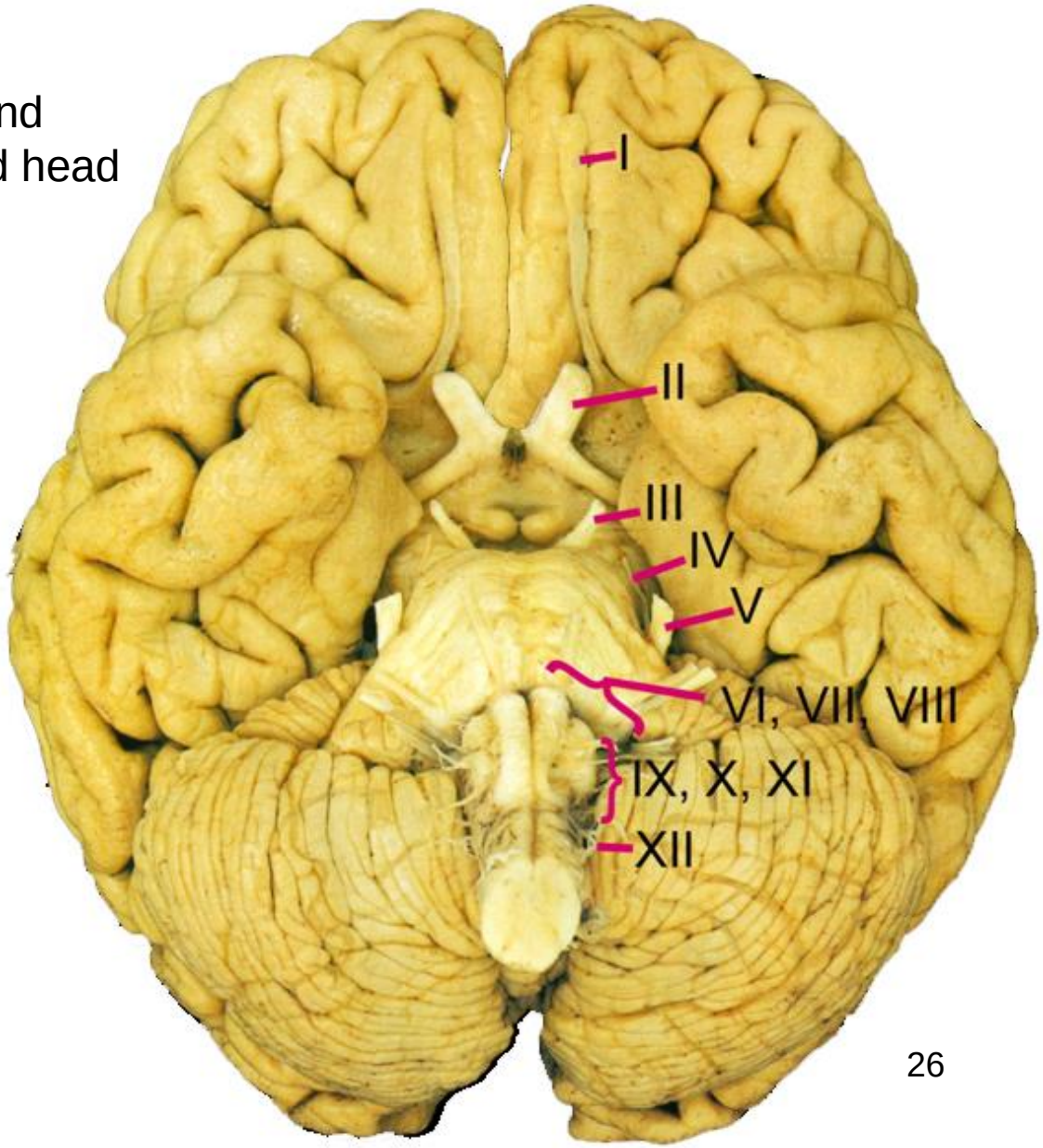
Facial Nerve (CN VII)

- Bell's Palsy is due to a loss of control of the facial muscles.
- Its cause is usually unknown.
- Generally it is temporary.

This man is trying to smile, but has no activation of his facial muscles on his right side.

Vestibulocochlear Nerve (CN VIII)

- Special sensory for hearing and vestibular sense (balance and head movement)
- Attaches to the medulla-pons junction



Glossopharyngeal Nerve (CN IX)

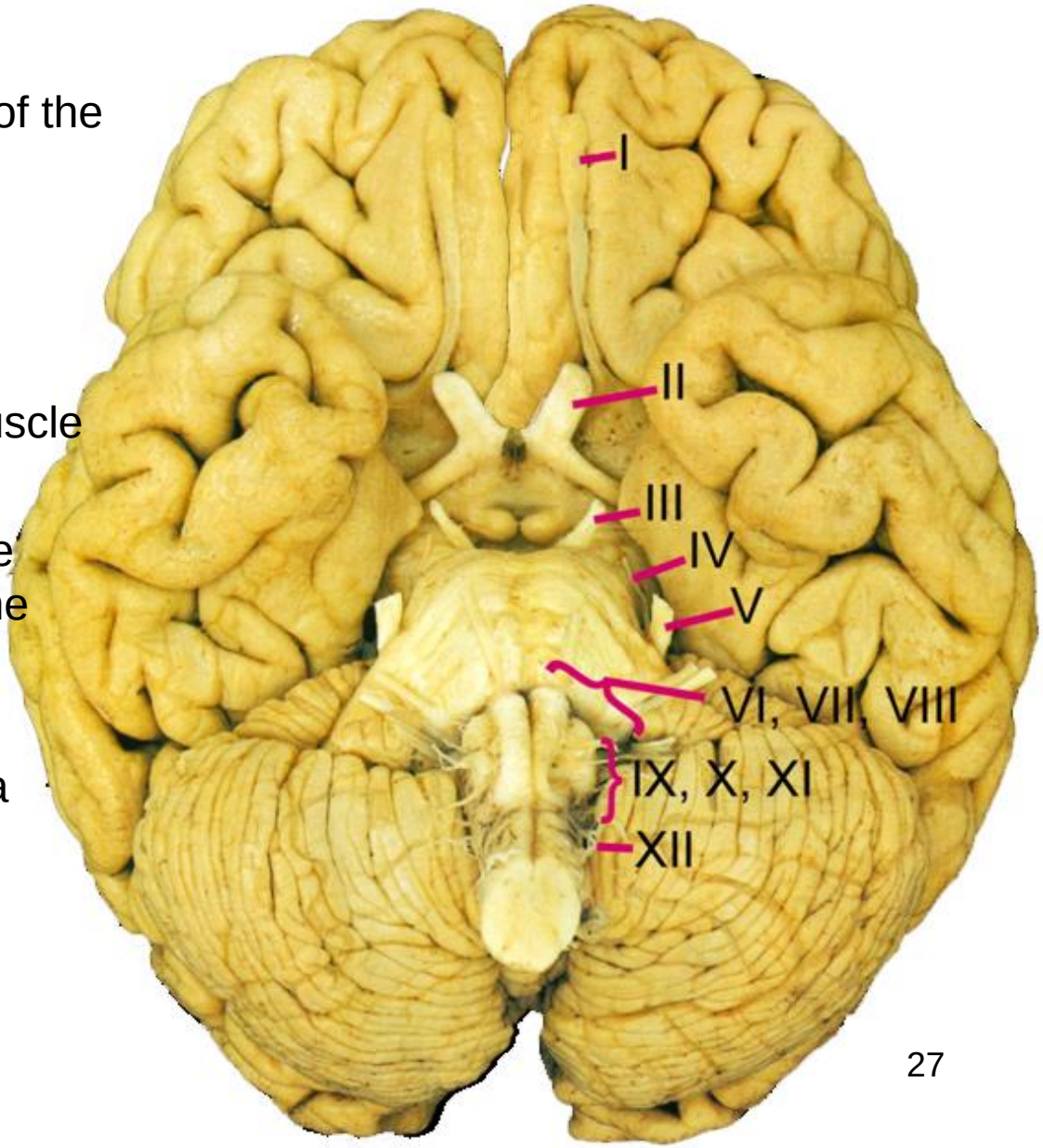
- General sensory for portions of the tongue and throat

  Special sensory for taste

  General motor for a throat muscle

  Parasympathetic motor for the parotid gland and glands of the throat

- Attaches to the upper medulla



Vagus Nerve (CN X)

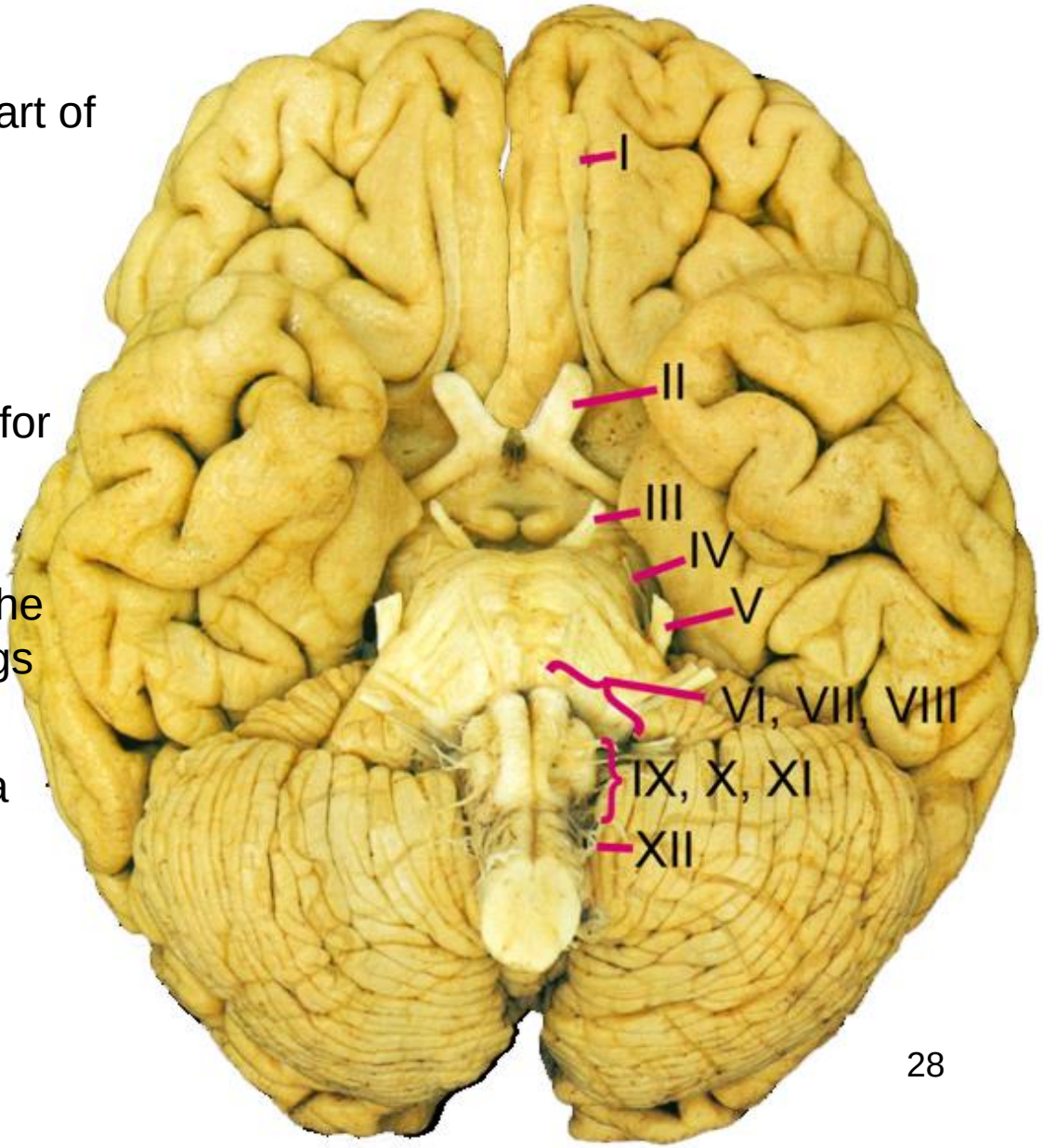
- General sensory for a large part of the viscera

  Special sensory for taste

  General motor for the larynx (for speaking)

  Parasympathetic to much of the digestive track, heart and lungs

- Attaches to the upper medulla

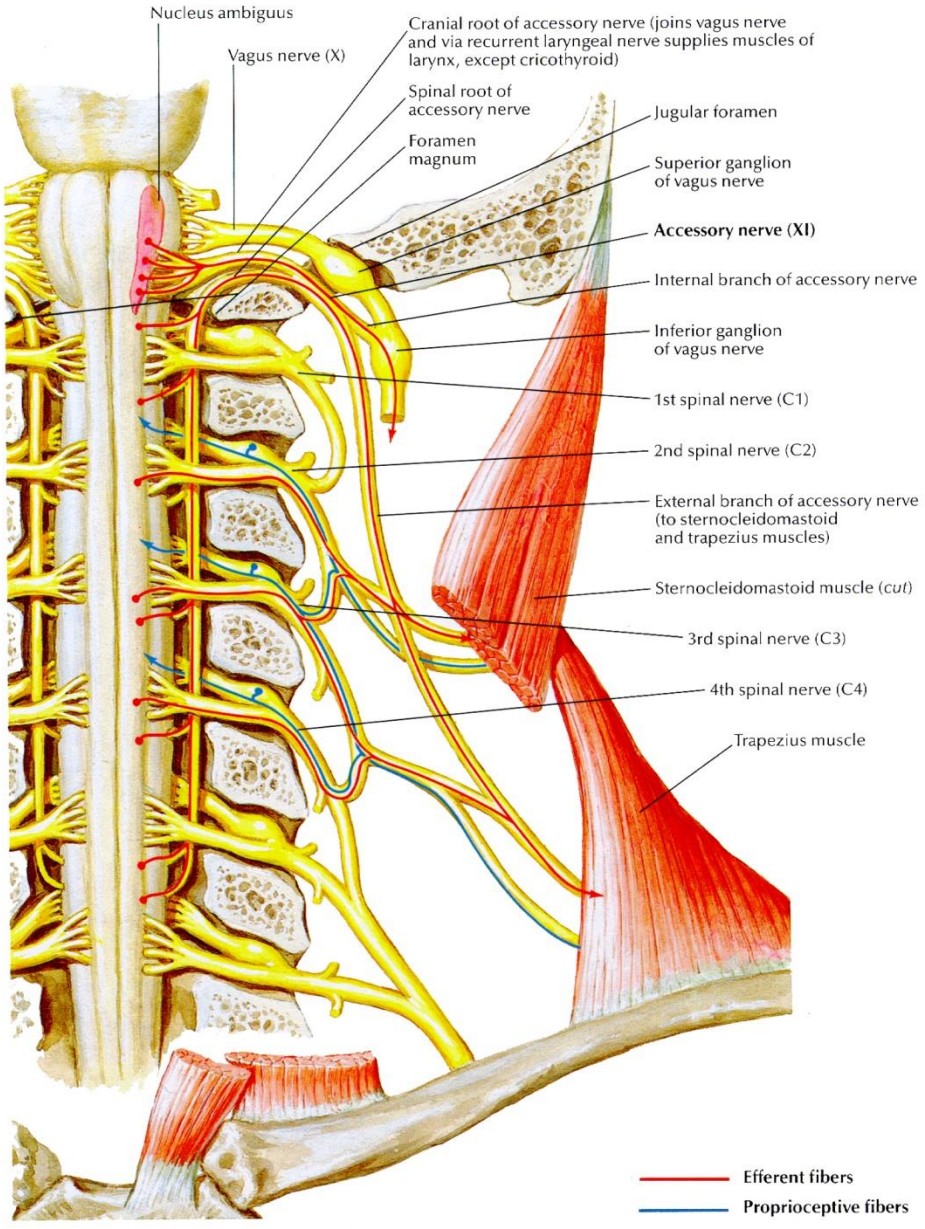


Accessory Nerve (CN XI)

Two parts:

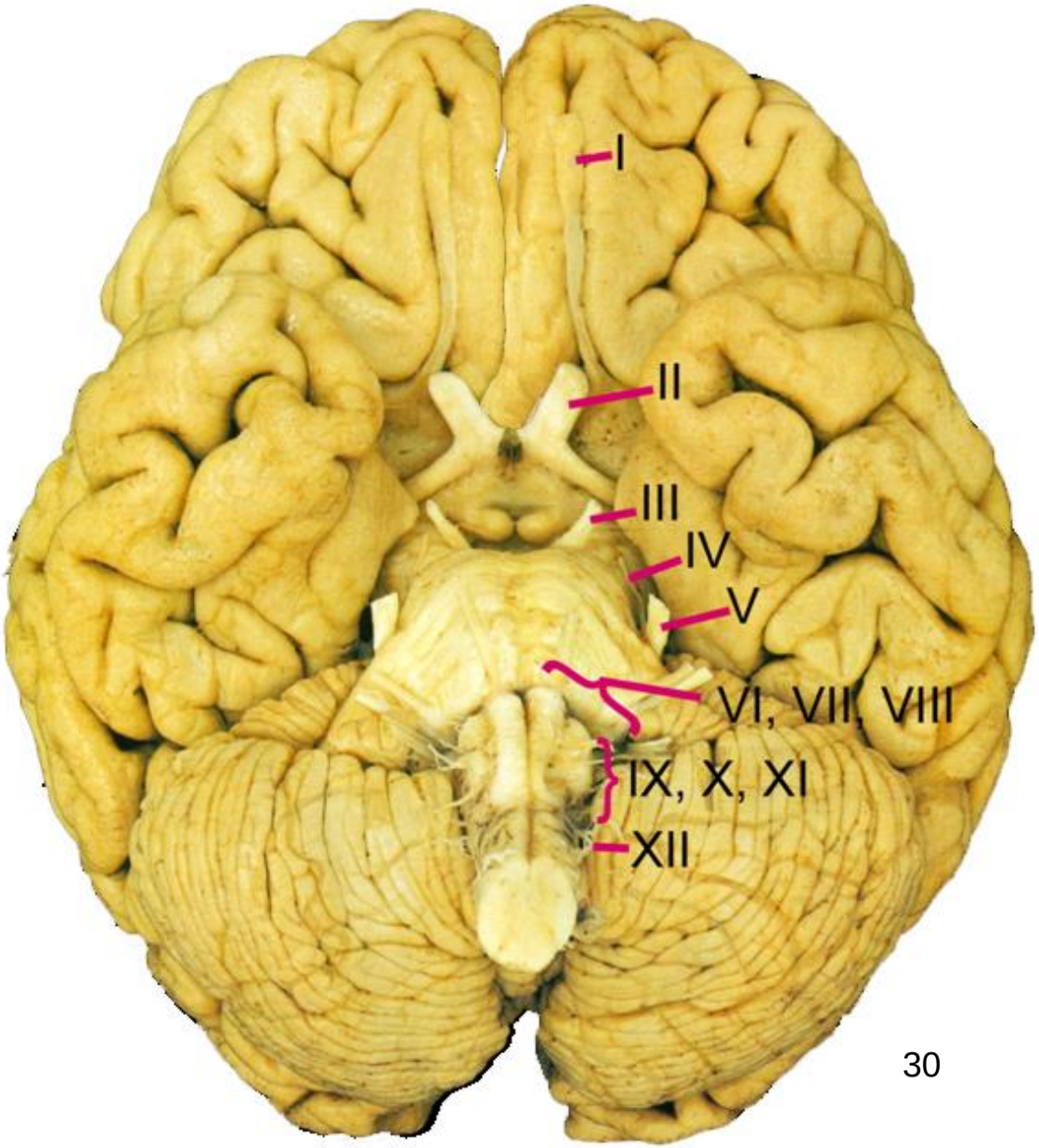
- Cranial portion that comes off the upper medulla, joins the cervical portion, then separates and joins the vagus nerve

- Spinal portion that comes off the cervical spinal cord, enters the cranium, joins the cranial portion, then exits the cranium to innervate neck muscles (general motor)



Hypoglossal Nerve (CN XII)

- General motor to the tongue muscles
- Attaches to the lower medulla



Hypoglossal Nerve (CN XII)

- Left hypoglossal nerve palsy (tongue deviates to the left side when protruded)