



Oliver

RETICULAR FORMATION

Nuclei of the reticular formation

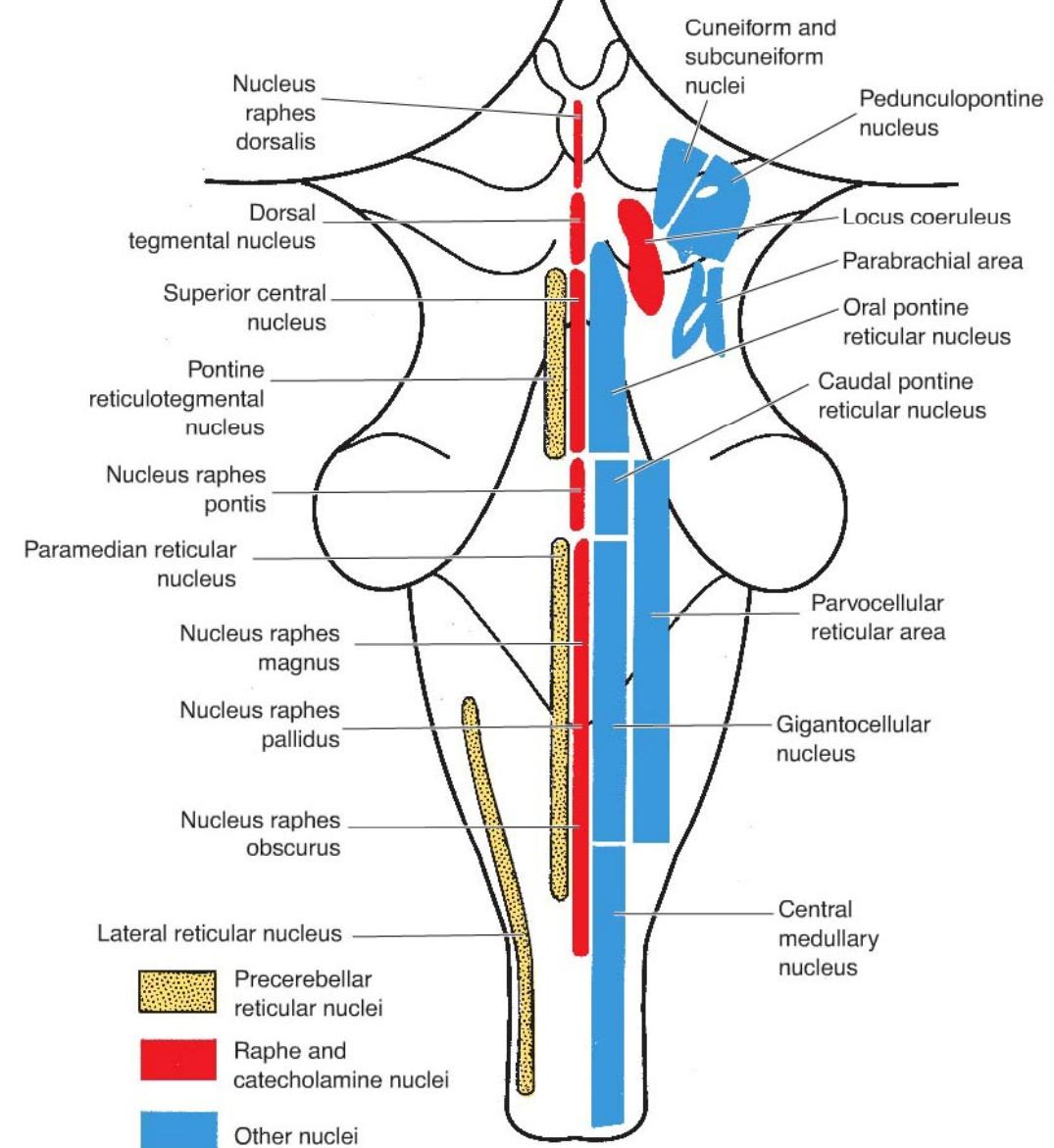


FIGURE 9-1 Diagram showing the positions of the larger nuclei of the reticular formation of the brain stem.

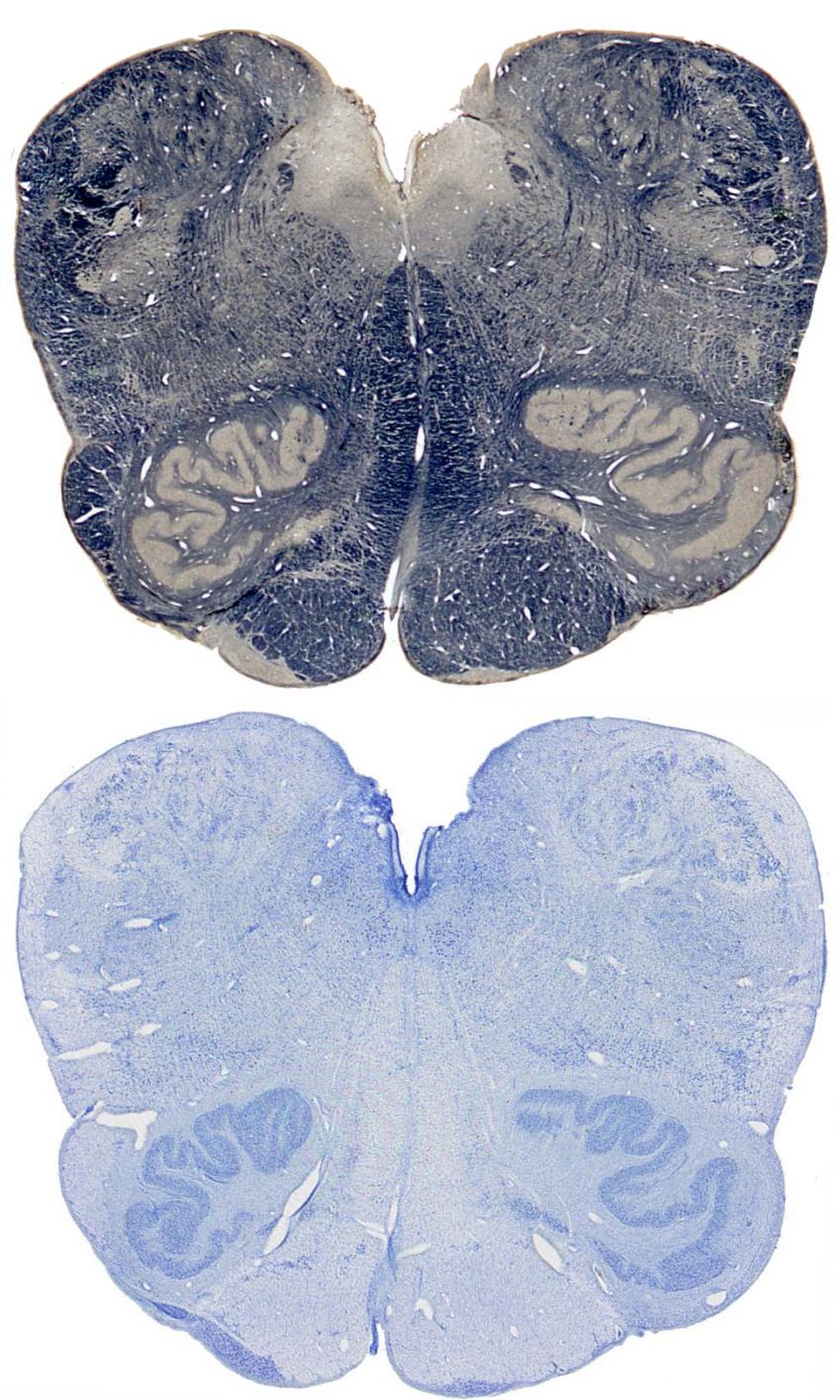
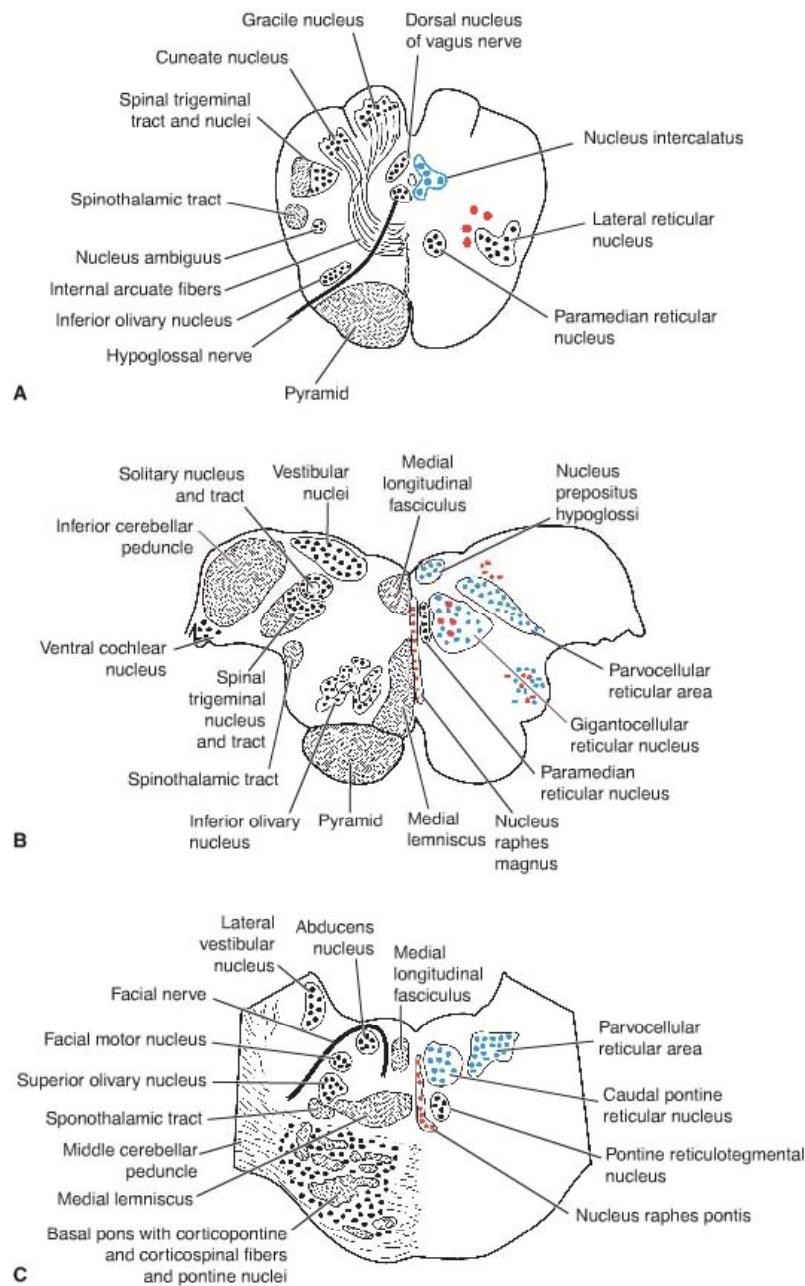
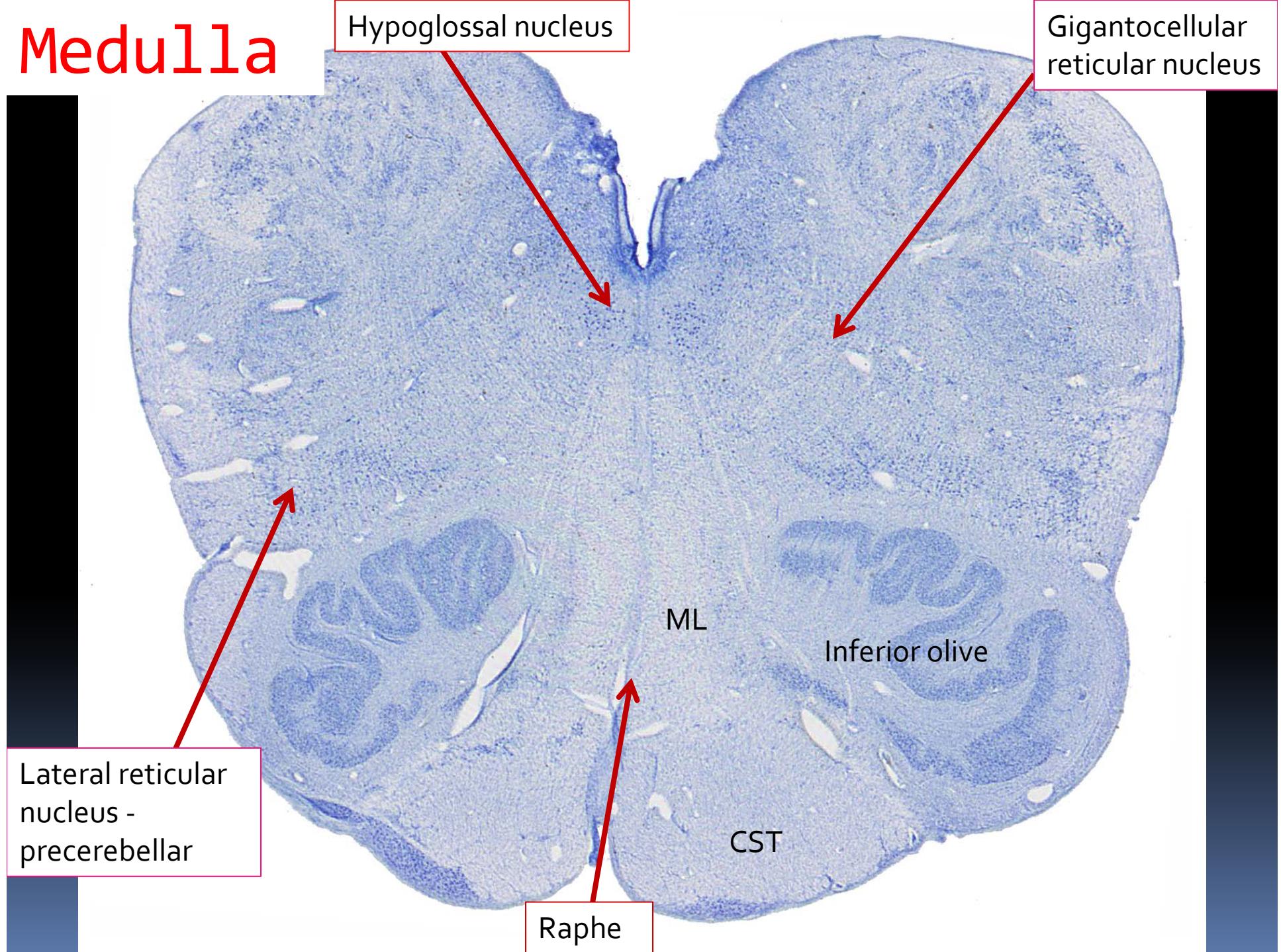


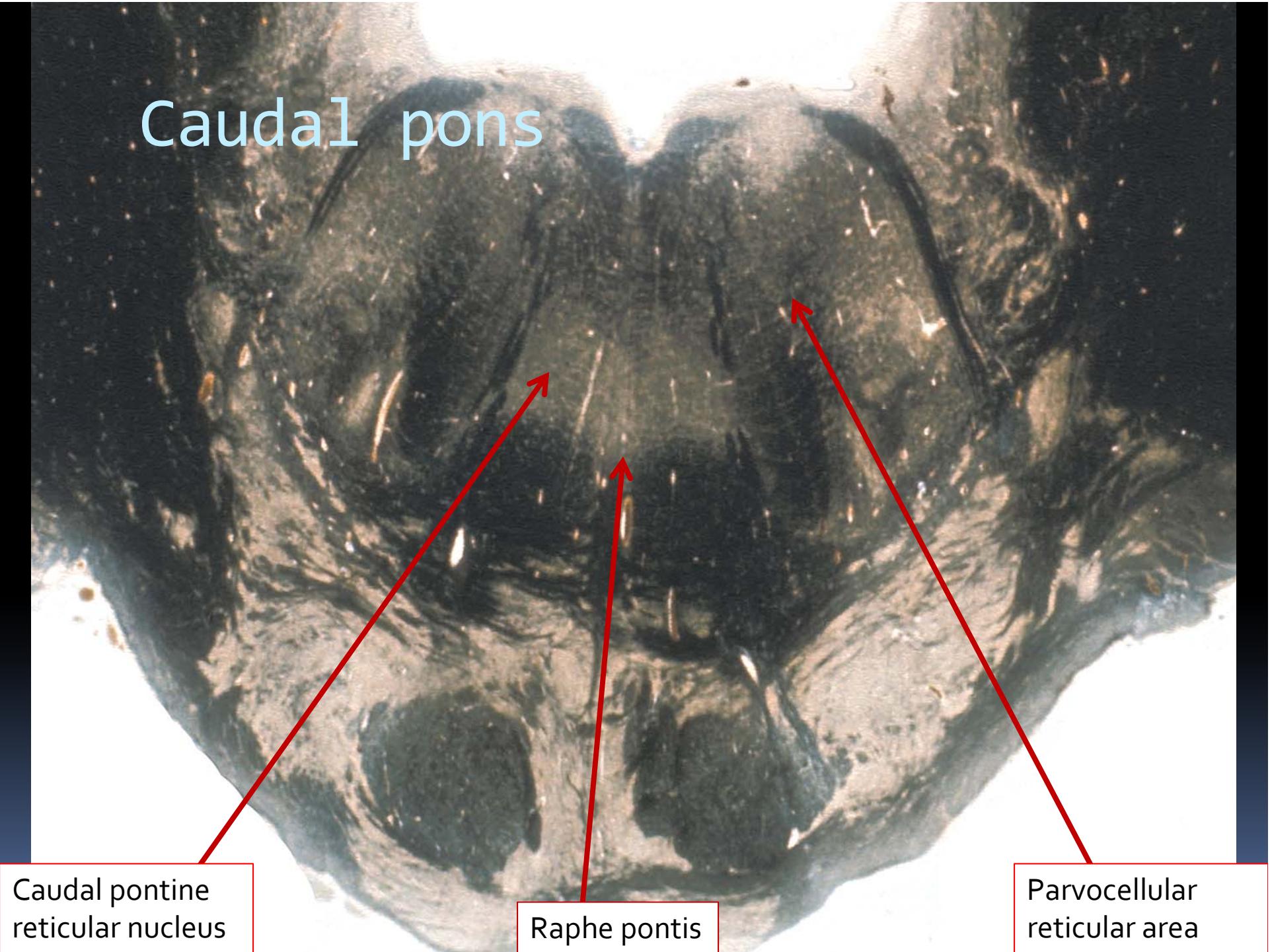
FIGURE 9-2 Transverse sections of the brain stem. The left side of each figure shows nuclei and tracts that are major anatomical landmarks. The right side shows the positions of reticular and other nuclei discussed in this chapter. Black dots indicate precerebellar nuclei; red dots indicate groups of serotonin- and catecholamine-containing neurons; and blue dots indicate other nuclei.

(continued)

Medulla



Caudal pons



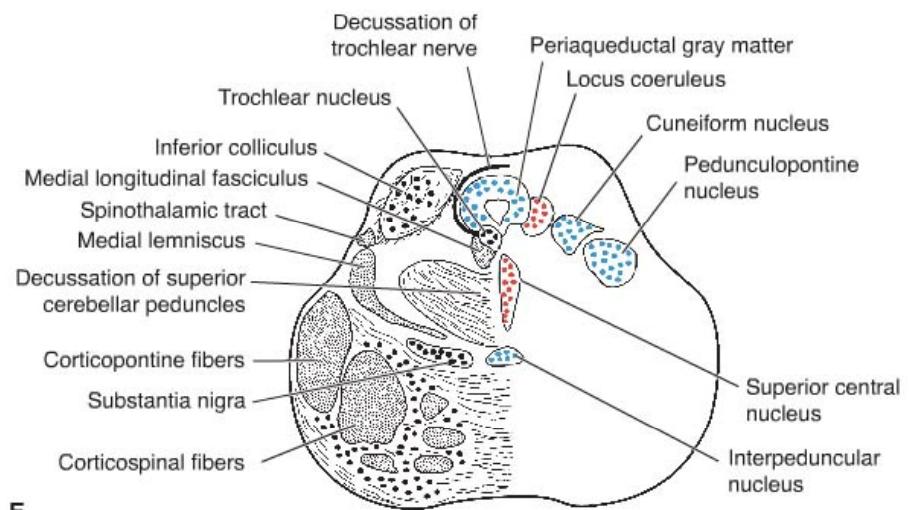
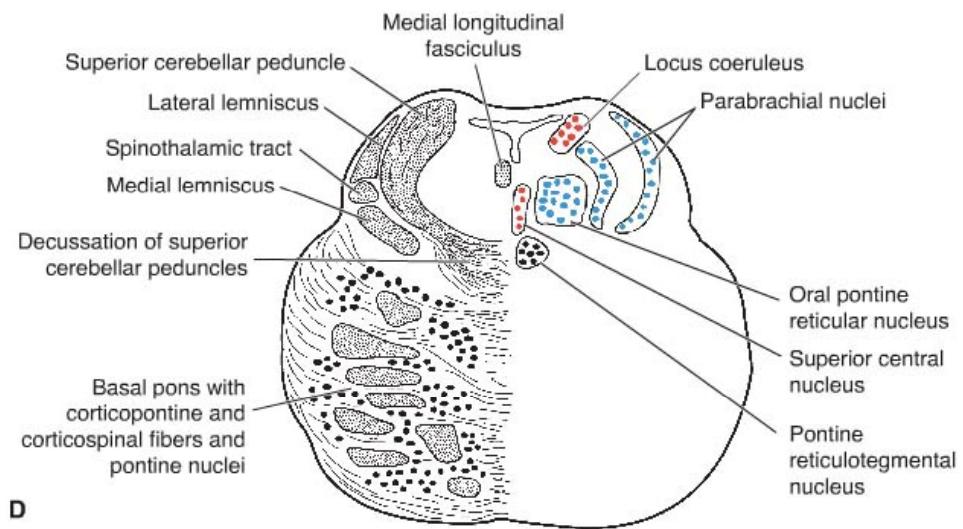
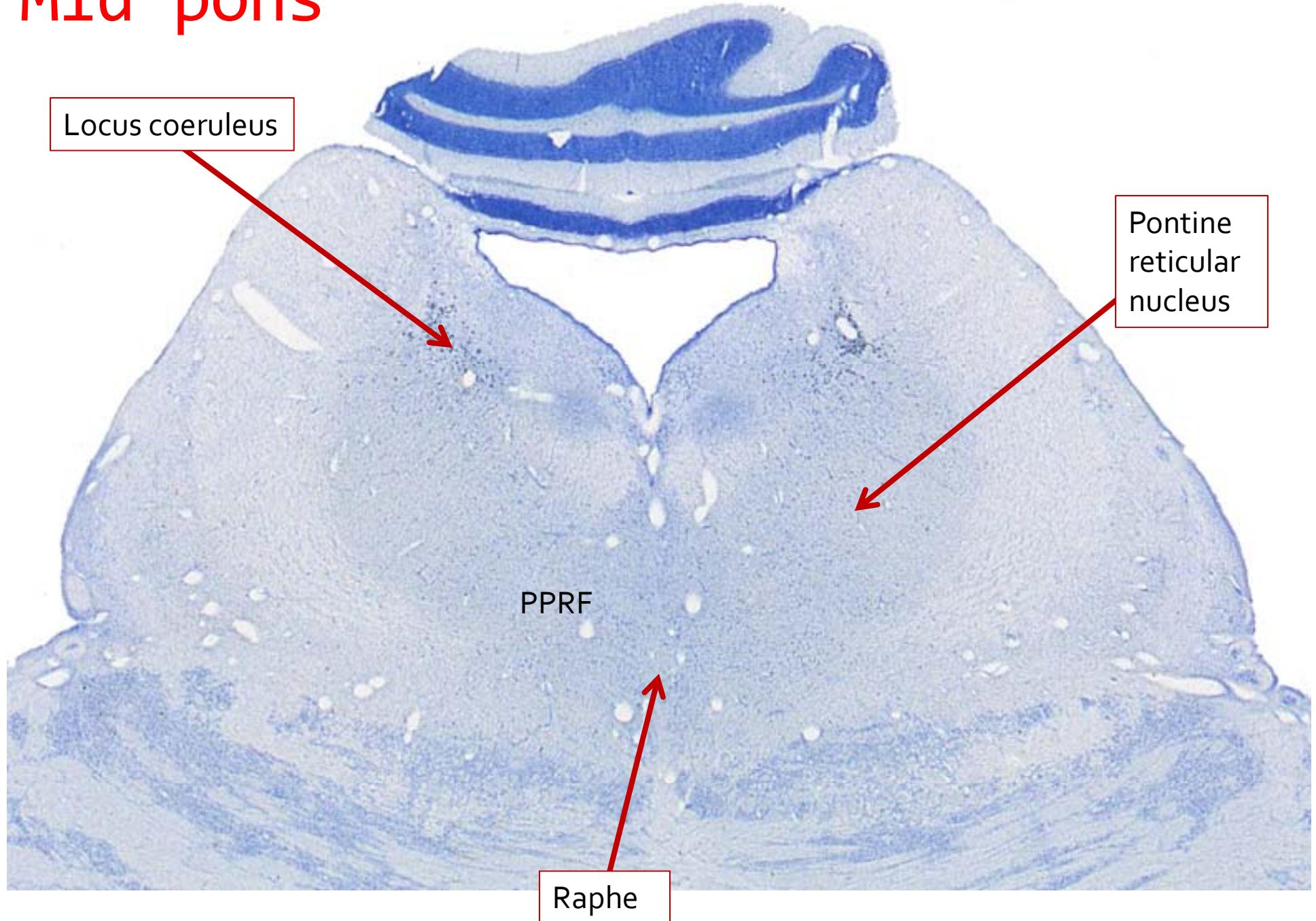
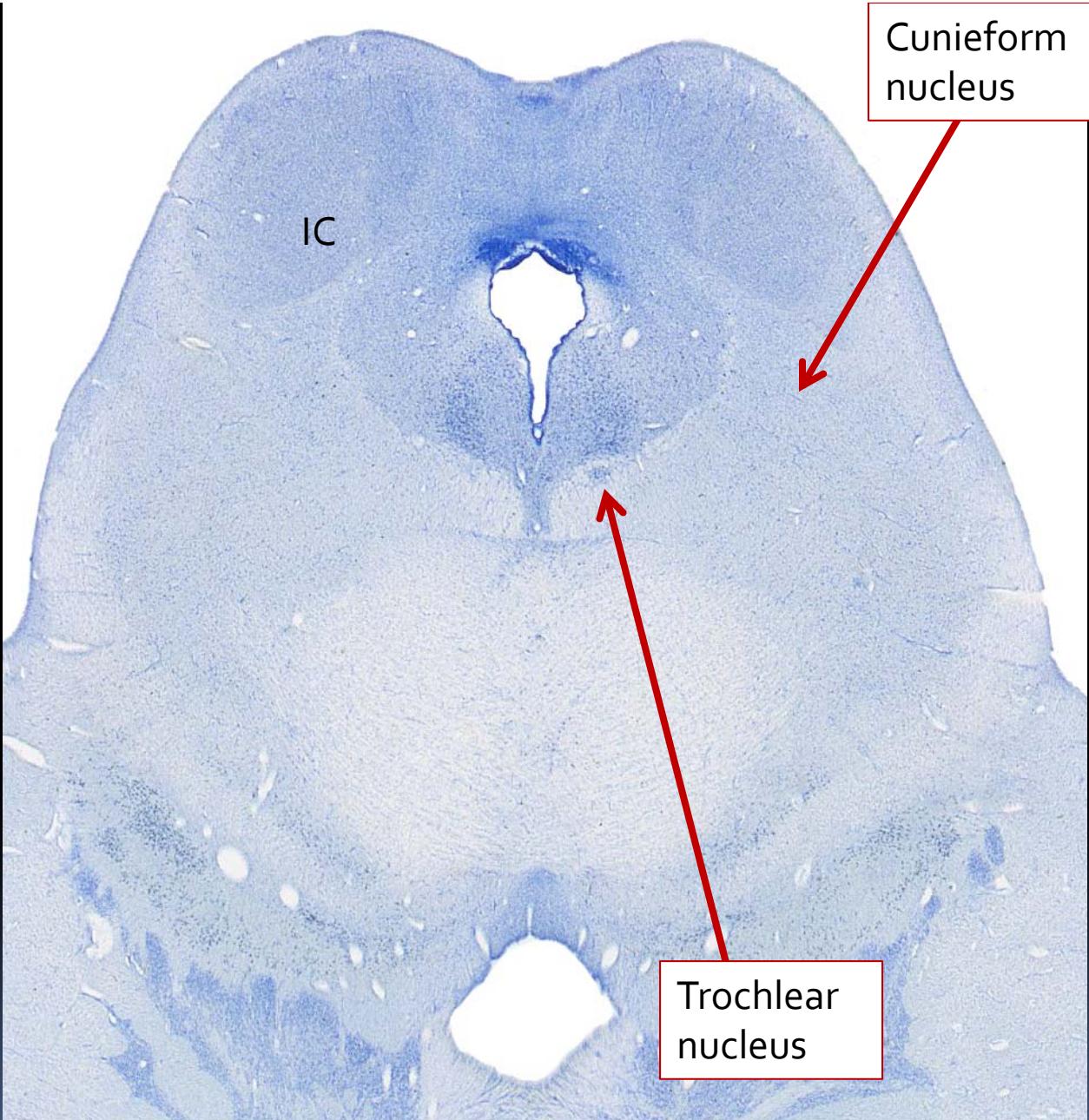
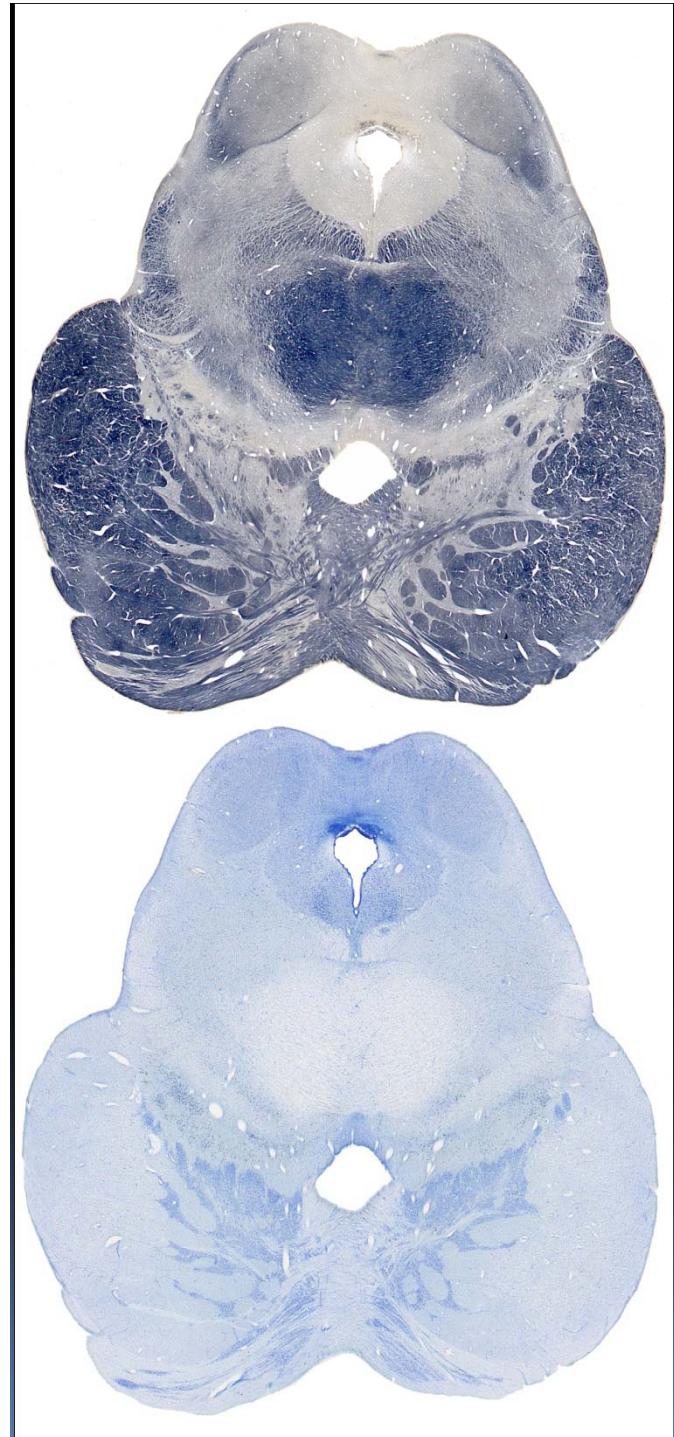


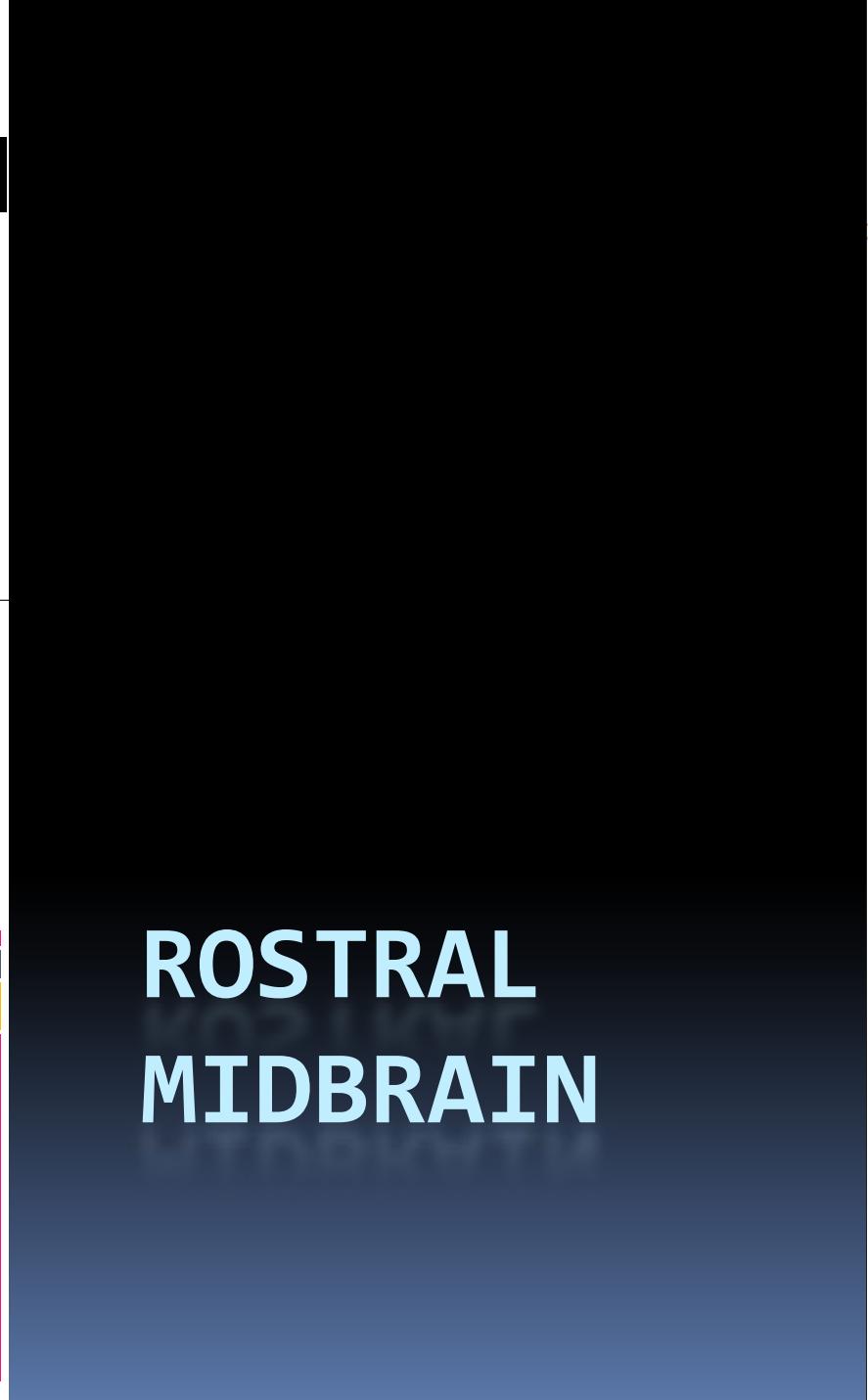
FIGURE 9-2 (continued) Transverse sections of the brain stem. The left side of each figure shows nuclei and tracts that are major anatomical landmarks. The right side shows the positions of reticular and other nuclei discussed in this chapter. Black dots indicate precerebellar nuclei, red dots indicate groups of serotonin- and catecholamine-containing neurons, and blue dots indicate other nuclei. **(A)** Nuclei at the level of the caudal pole of the inferior olive nucleus, in the closed part of the medulla. (The unlabeled red dots indicate scattered adrenergic neurons.) **(B)** Nuclei at the level of the rostral pole of the inferior olive nucleus, in the open part of the medulla. (The unlabeled red dots indicate groups of noradrenergic and adrenergic neurons. The blue dots dorsolateral to the inferior olive nucleus indicate the probable position of the ventral superficial reticular area of the medulla.) **(C)** Nuclei in the caudal pontine tegmentum, at the level of the internal genu of the facial nerve. **(D)** Pontine tegmentum at a level rostral to the trigeminal motor nucleus. **(E)** Nuclei at the level of the caudal end of the inferior colliculus.

Mid pons

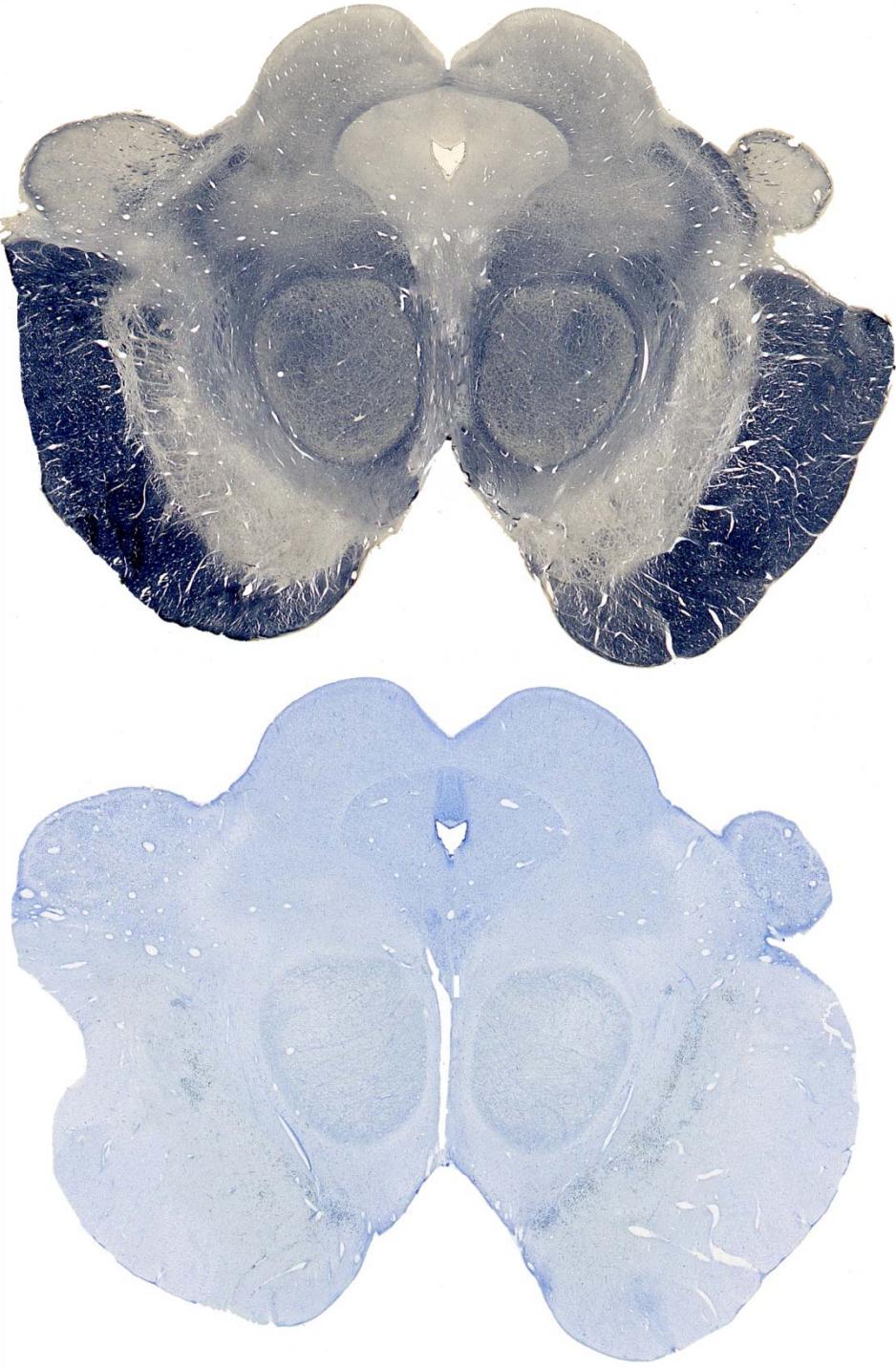




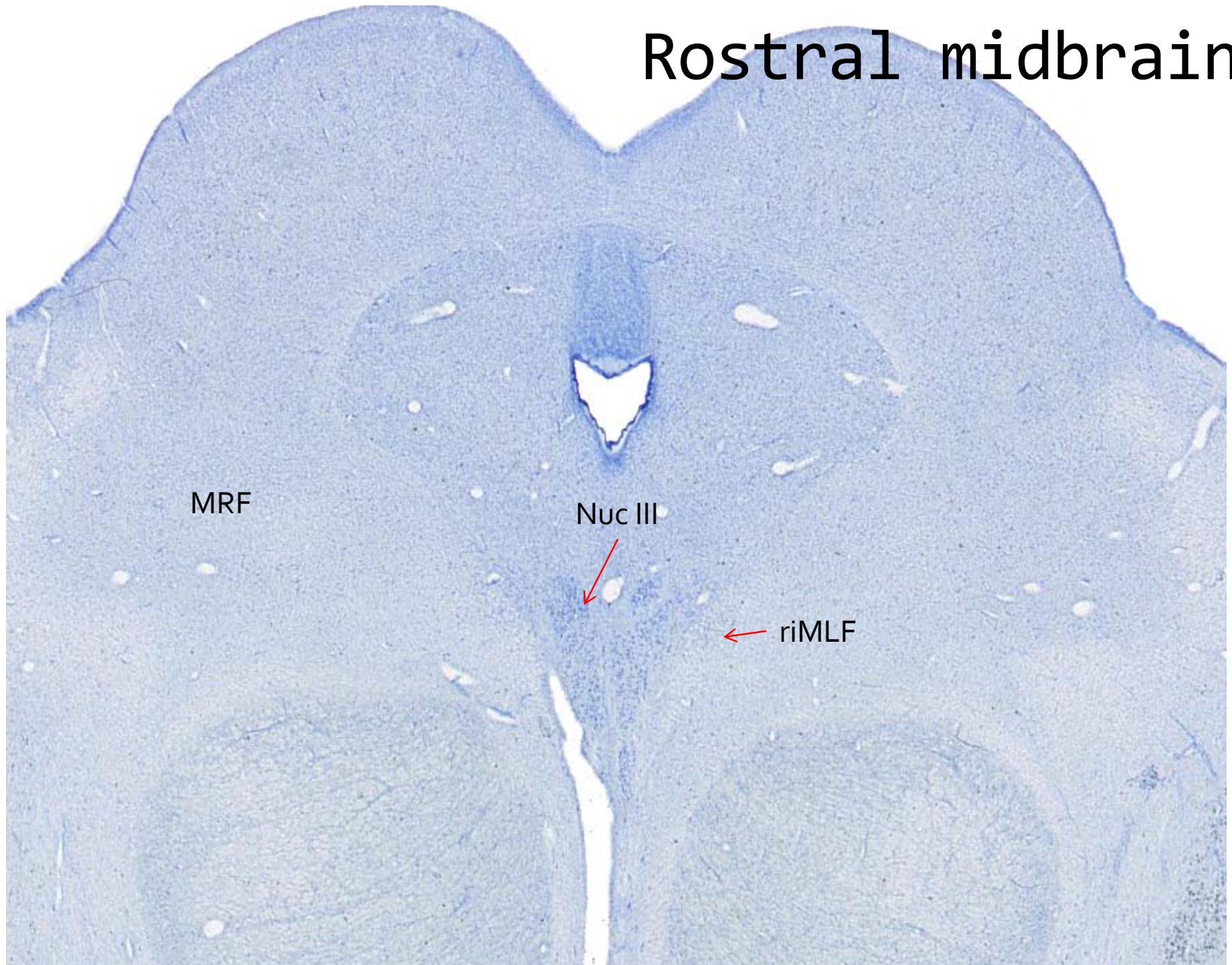
Caudal midbrain



ROSTRAL MIDBRAIN



Rostral midbrain



General Features

- Diffuse appearance – nuclei are difficult to see
- Cells at raphe
- Very large neurons (gigantocellular) tend to be at paramedian location
 - Large cells have large dendritic fields
 - Dendritic fields are heavily overlapping
 - Inputs tend to be from many sources and highly overlapping (not topographic)
 - Axons may be ascending or descending or both
 - Outputs go to many targets often over long distances
- Smaller cells (parvocellular) tend to be lateral

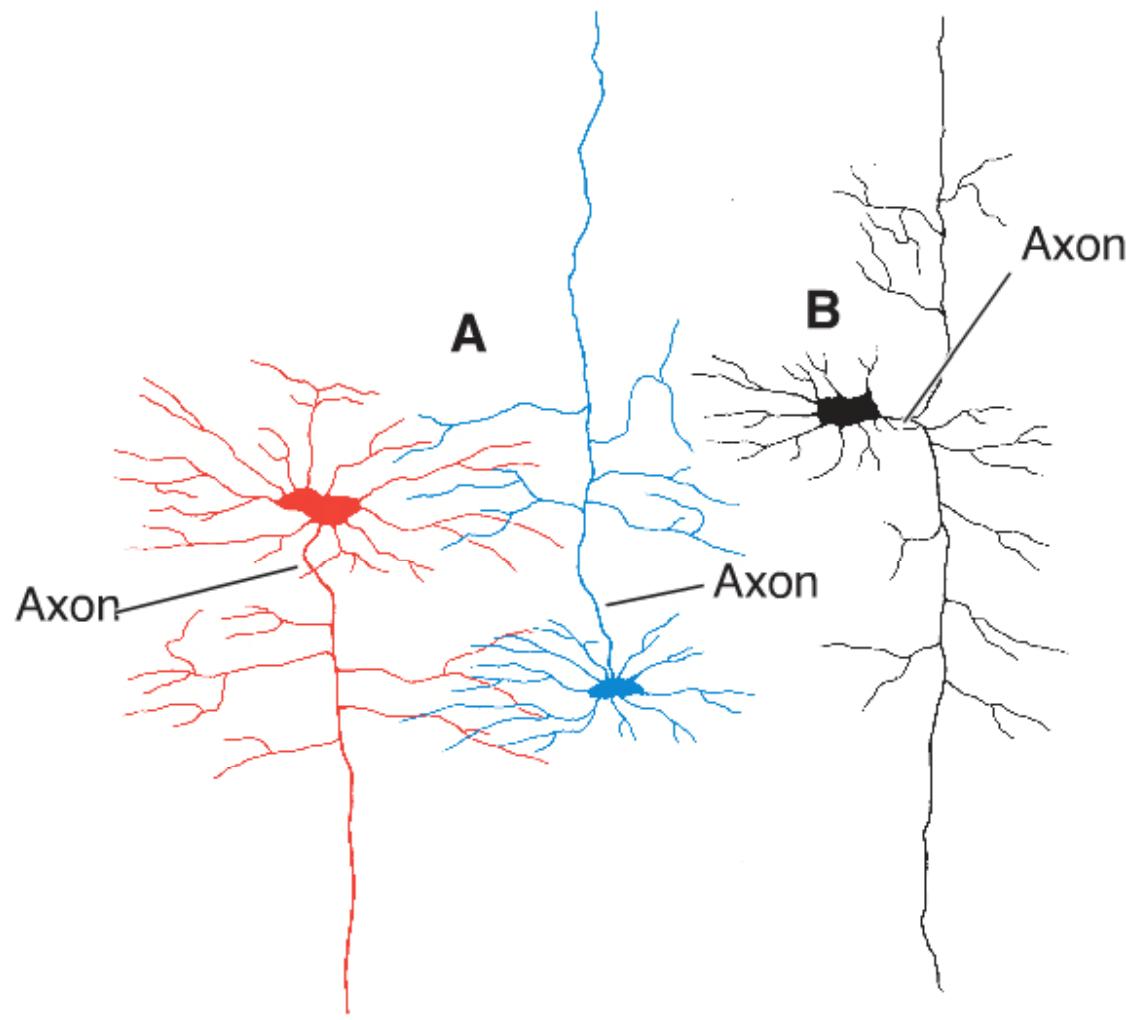


FIGURE 9-5 Neurons of the reticular formation. **(A)** Interaction between dendrites and collateral axonal branches of neurons with ascending (blue) and descending (red) projections. **(B)** A neuron whose axon divides into long ascending and descending branches.

Long connections of RF

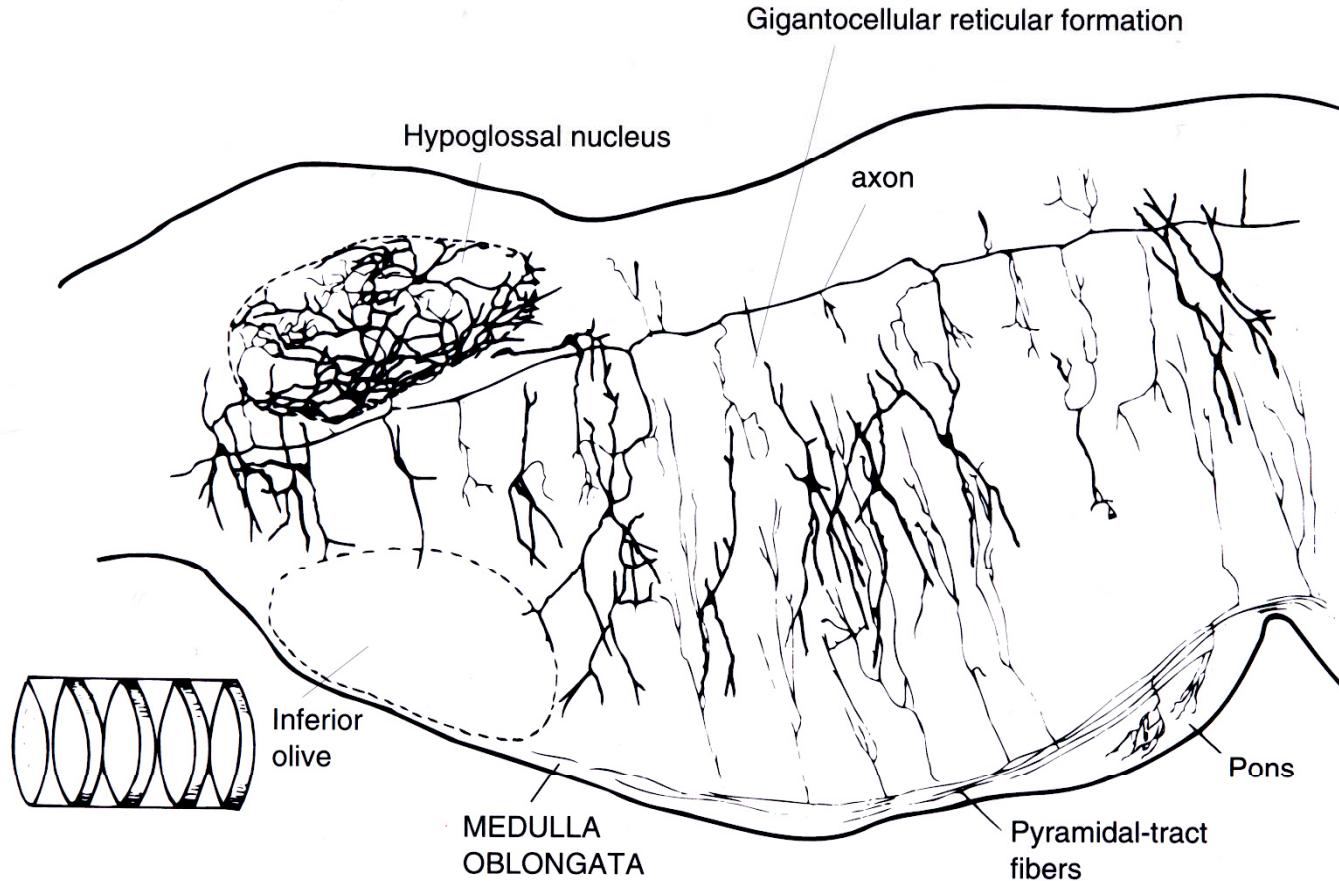


Figure 15.4 *Orientation of dendrites in the reticular formation.* Sagittal section through the medulla (rat). Note the long, straight dendrites, which are typical of the neurons of the reticular formation, in contrast to the neurons of a cranial nerve nucleus (the

hypoglossal) and other specific brain stem nuclei. A long axon with numerous collaterals extending ventrally in the transverse plane is also shown. Collaterals of the pyramidal tract fibers also enter the reticular formation. From Scheibel and Scheibel (1958).

Central group of reticular nuclei

- Reticulospinal tract
- Reticulothalamic tract

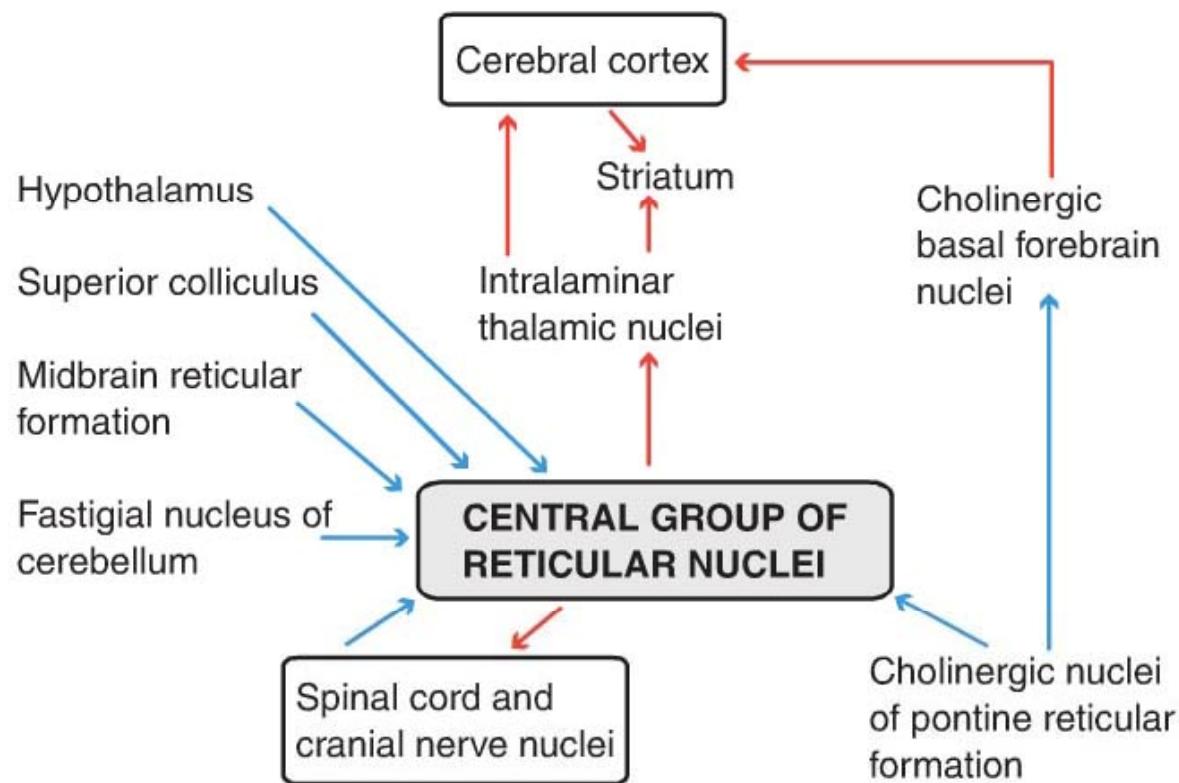
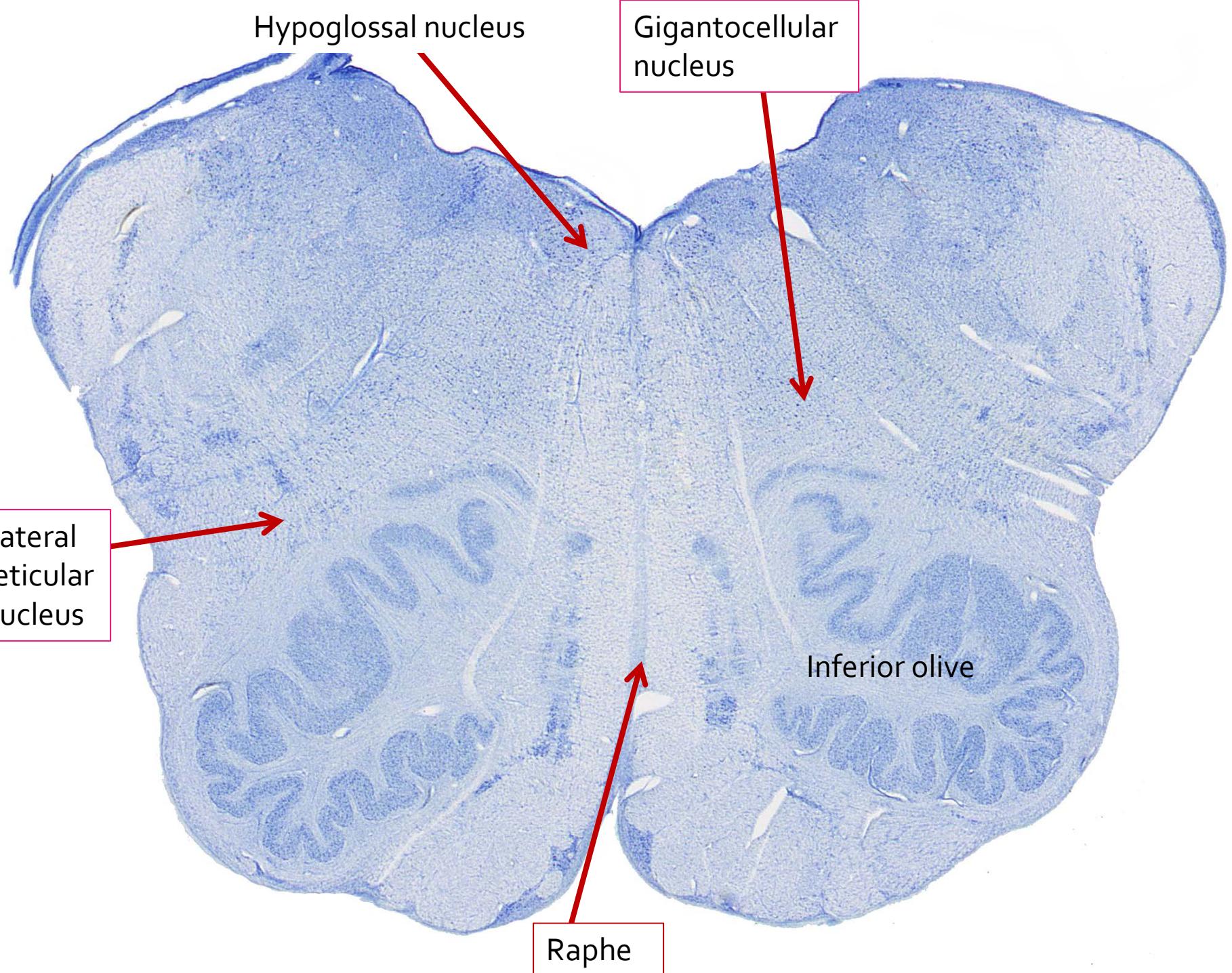


FIGURE 9-4 Major connections of the central group of reticular nuclei.



Precerebellar Nuclei

- Lateral reticular nucleus
- Paramedian reticular nucleus
- Pontine reticulotegmental nucleus
- Inputs to cerebellum from reticular formation
- Output from cerebellum to reticular formation nuclei

Raphe nuclei

- Serotonergic neurons

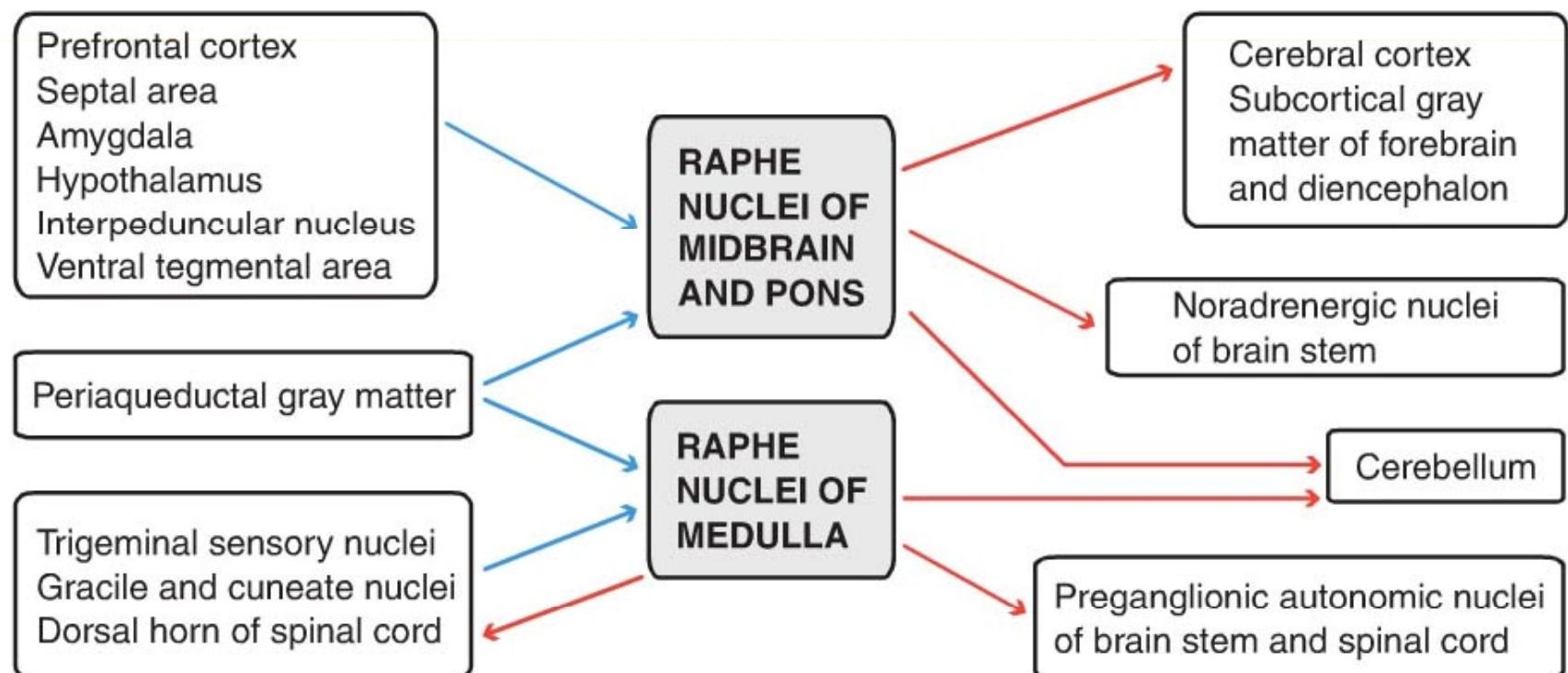
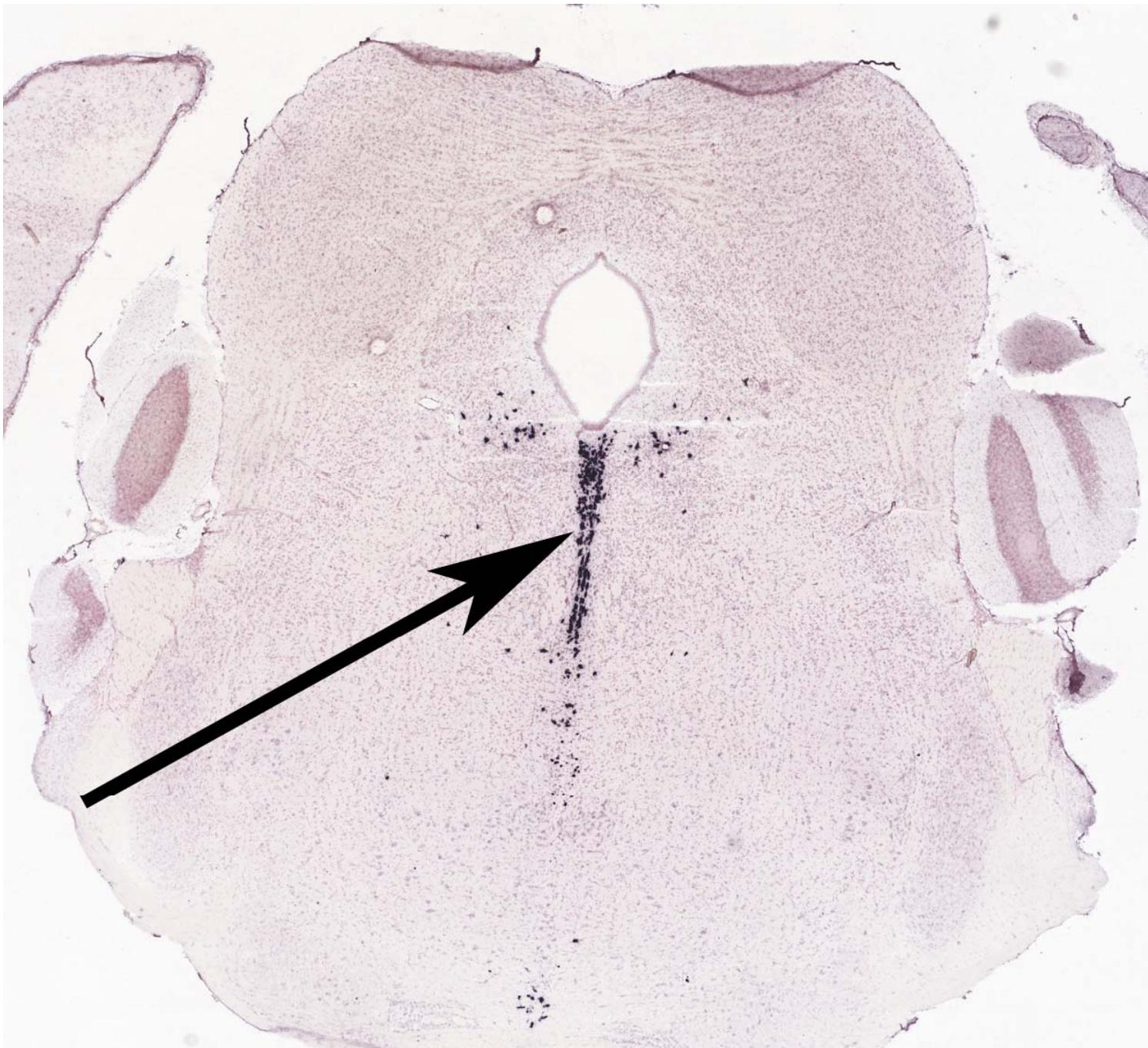


FIGURE 9-3 Major connections of the serotonergic raphe nuclei.



tryptophan hydroxylase (TPH); TPH₂ *in situ* shows location of serotonin

Cholinergic neurons

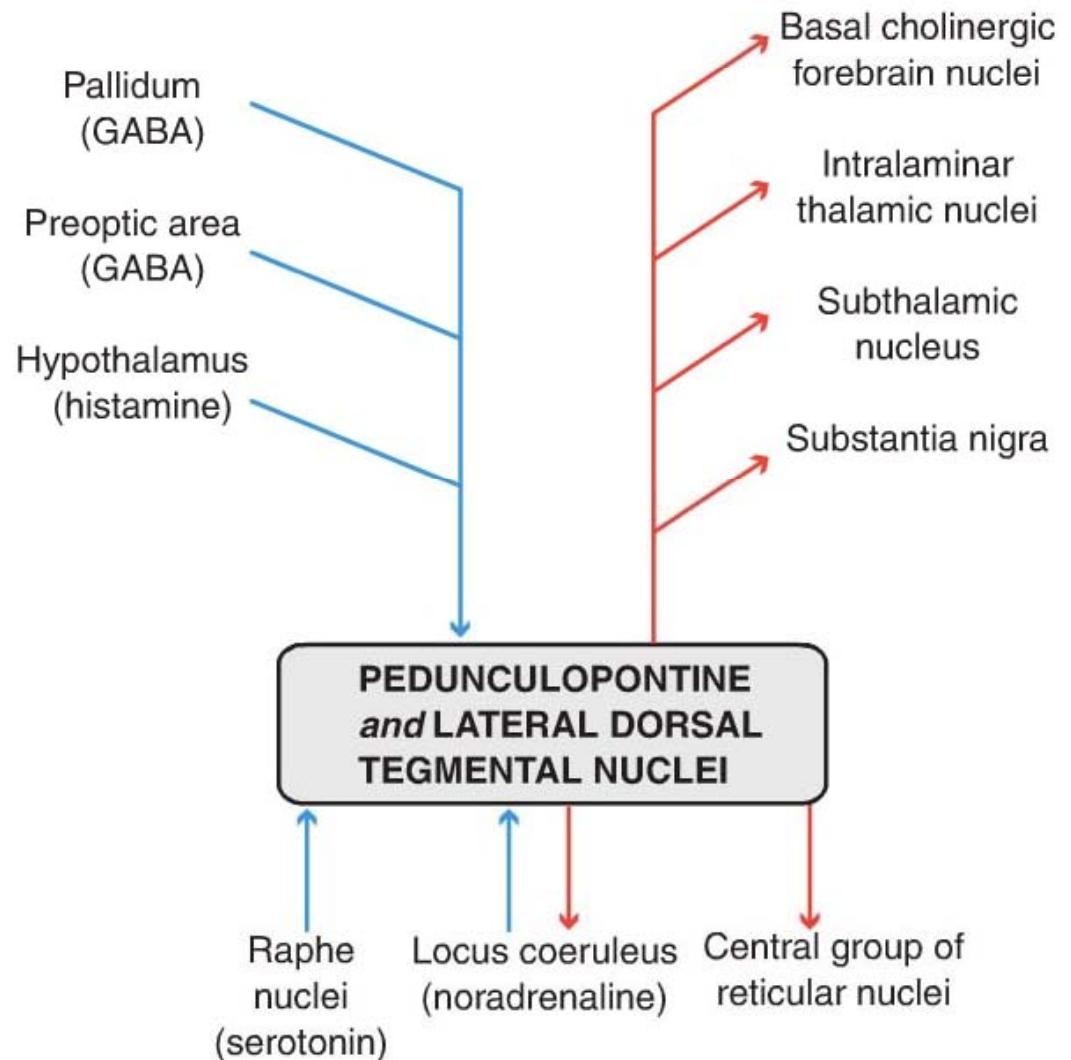
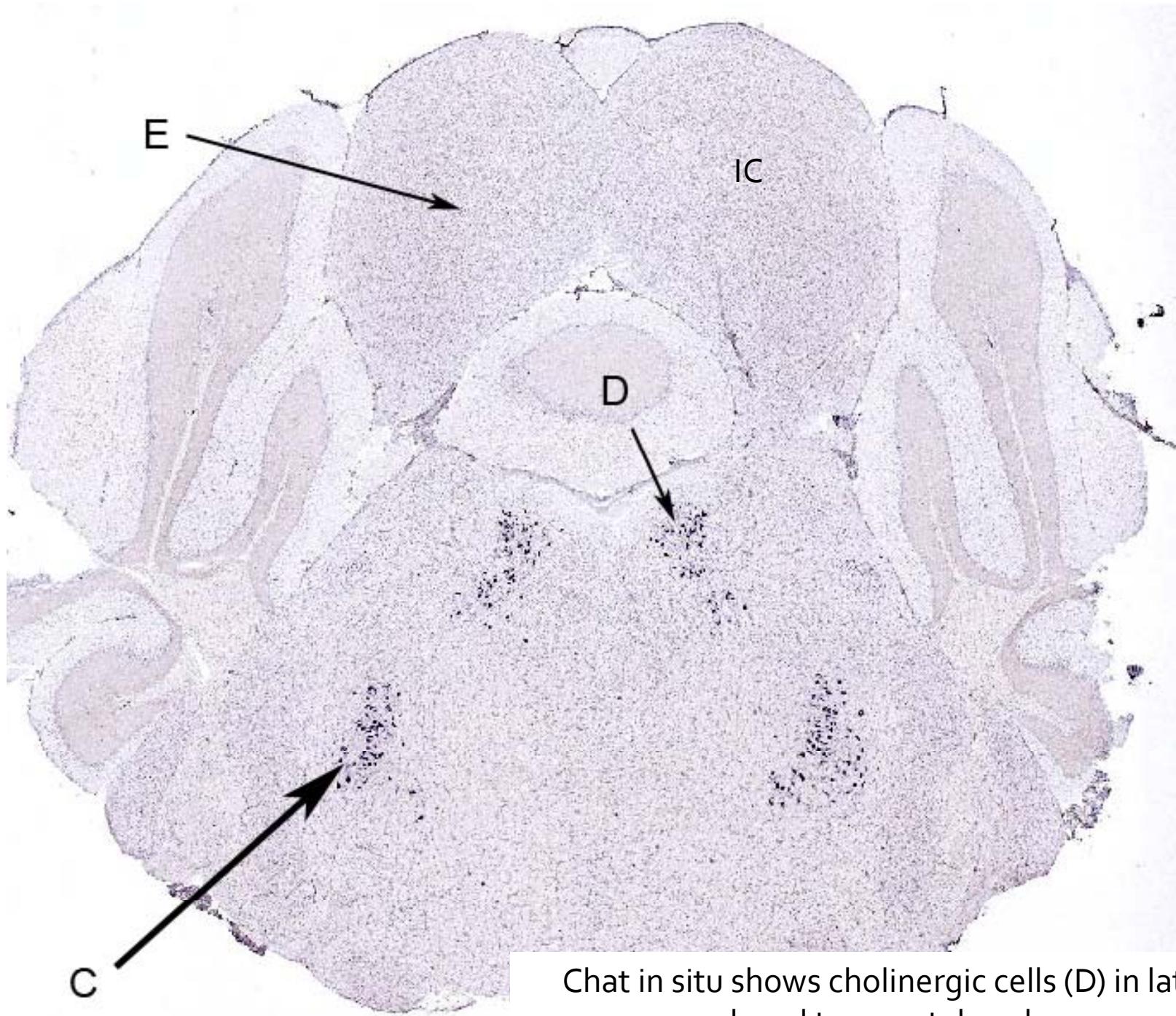


FIGURE 9-6 Major connections of the cholinergic nuclei of the brain stem.



Chat in situ shows cholinergic cells (D) in lateral
dorsal tegmental nucleus

Catecholamine nuclei

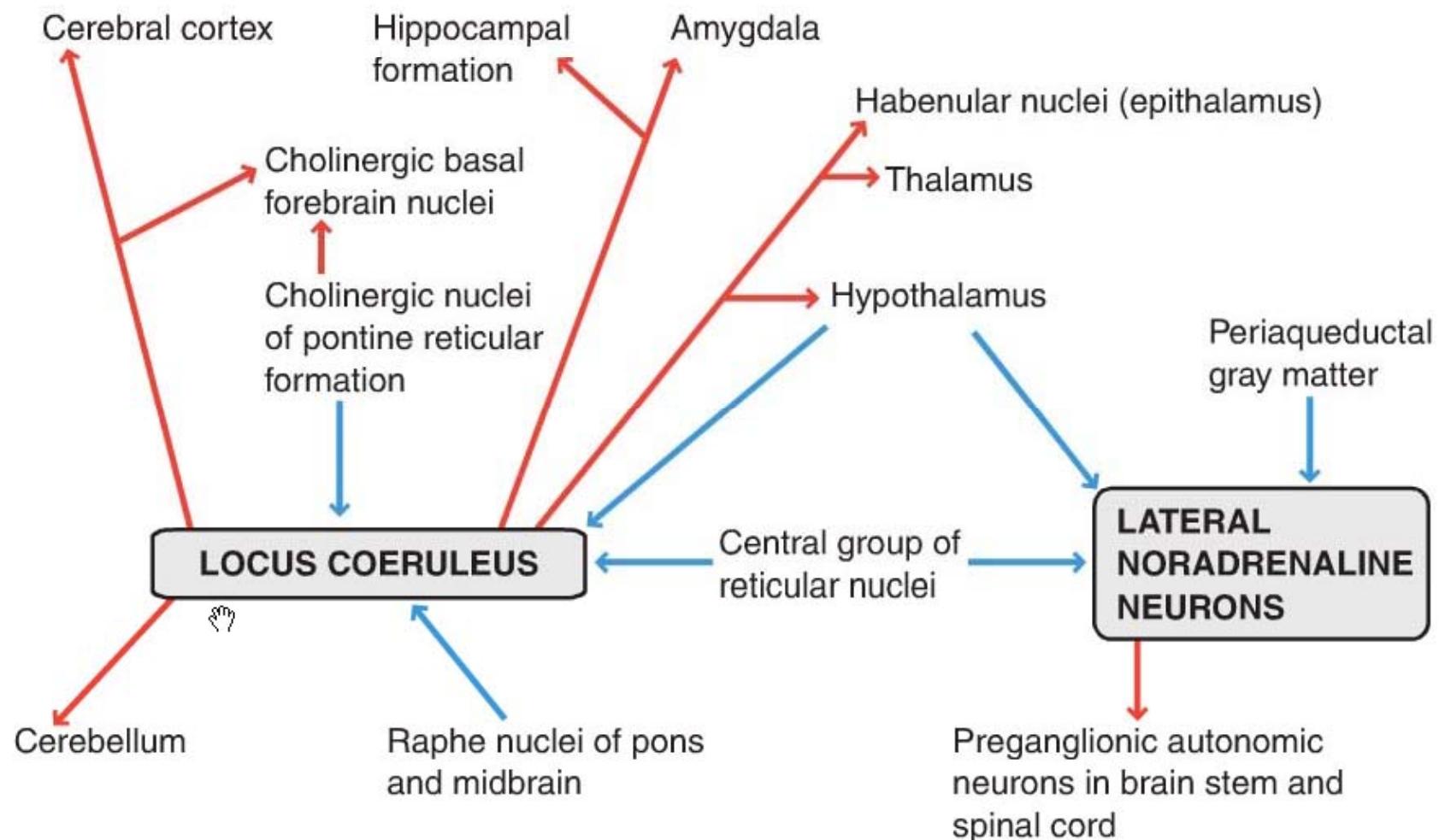
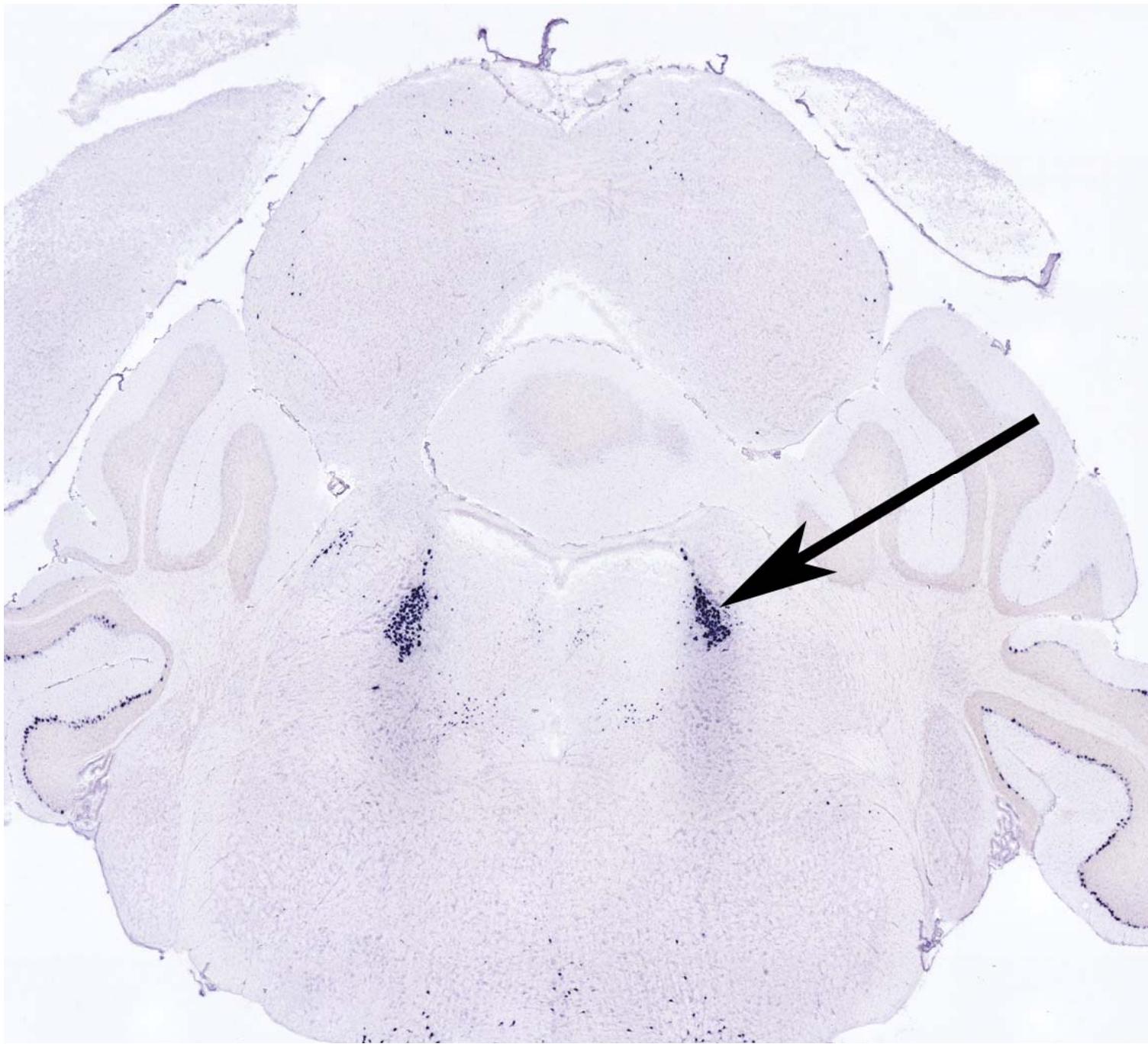


FIGURE 9-7 Major connections of the noradrenergic nuclei of the brain stem.



Tyrosine hydroxylase in situ shows location of locus coeruleus



FUNCTIONS FOR SLEEP AND AROUSAL

Arousal

- Neurons important for arousal
- Brainstem and thalamus must stimulate cortex
- NE neurons of locus coeruleus
- Cholinergic neurons
- Central RF

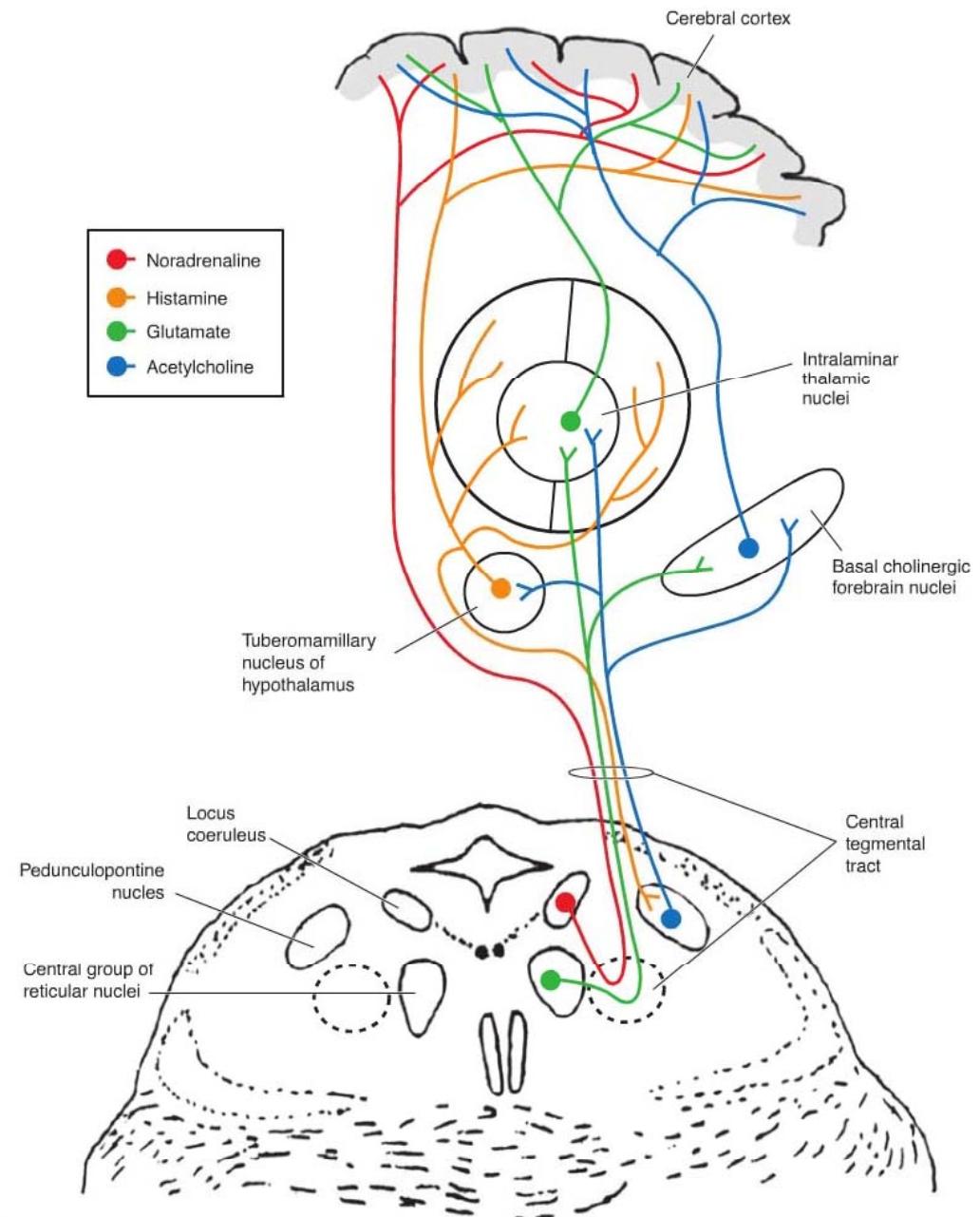


FIGURE 9-8 The ascending reticular-activating system. This diagram shows the groups of neurons that are more active in the alert state and less active during slow-wave (non-REM) sleep. With the notable exception of the locus coeruleus, these neurons are active also in REM sleep.

Sleep

- Neurons important for sleep
- Serotonergic raphe nuclei active during deep sleep
- Peptide (orexin) stimulation of cholinergic system is reduced
- Preoptic GABA neurons active during sleep and inhibit locus coeruleus

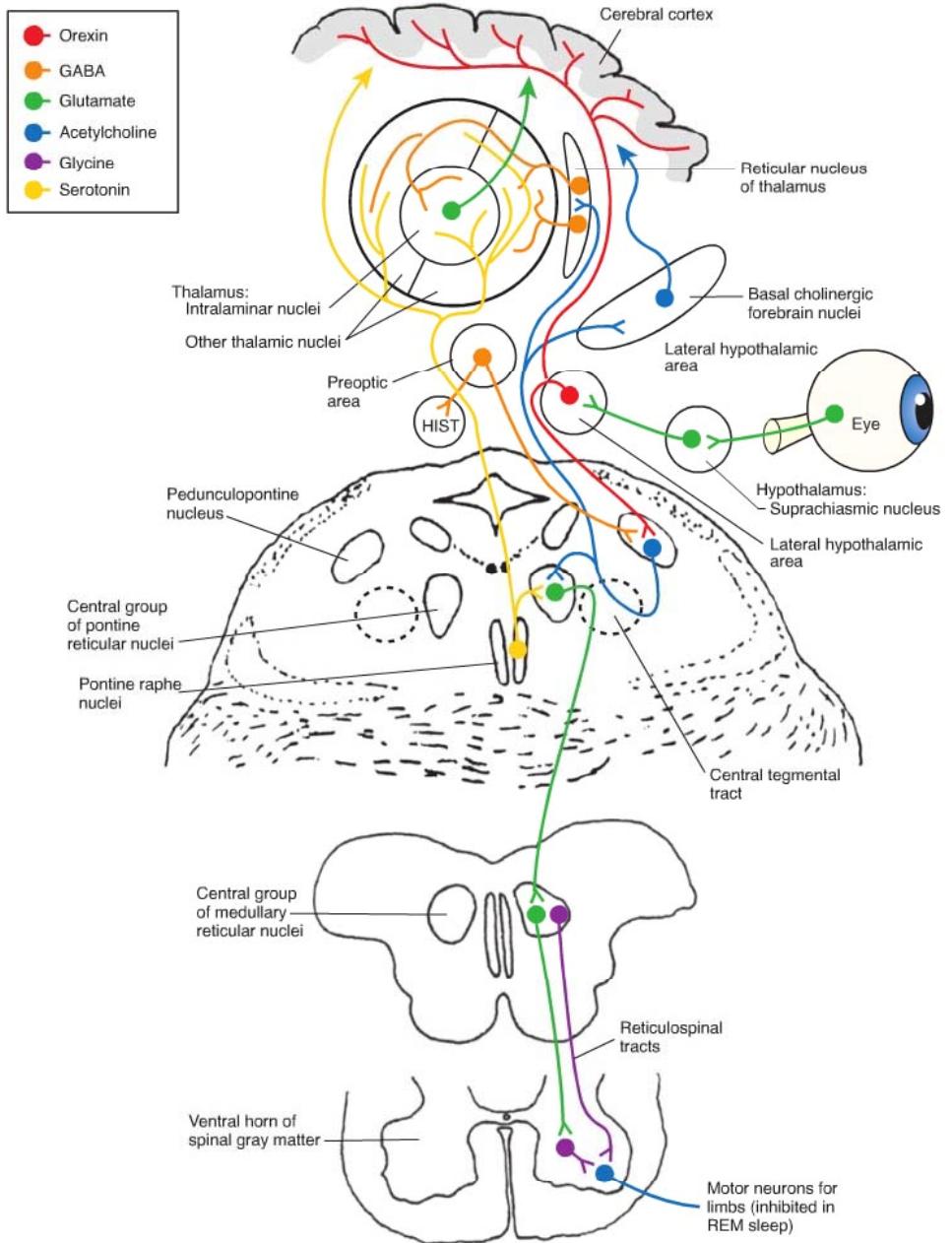
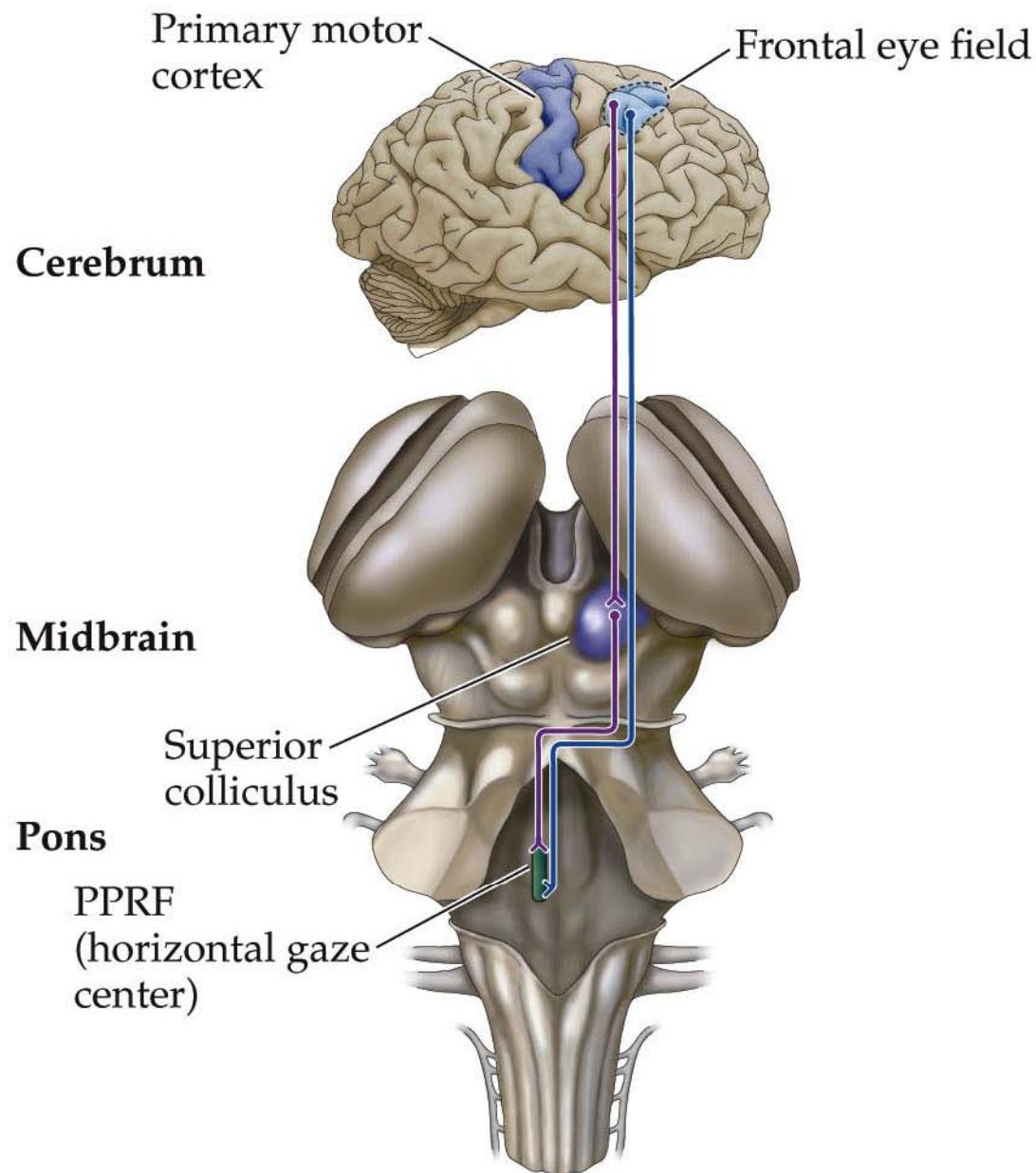


FIGURE 9-9 Diagram showing groups of neurons that are active in sleep. The serotonergic neurons and the GABA-ergic hypothalamic neurons are more active in slow-wave (non-REM) sleep. The other pathways are active in REM sleep though the physiological role of the orexin neurons is still uncertain. The arrows pointing up indicate extensive distribution of axonal branches to the cortex. The descending pathways mediate the inhibition of motor activity during periods of REM sleep.

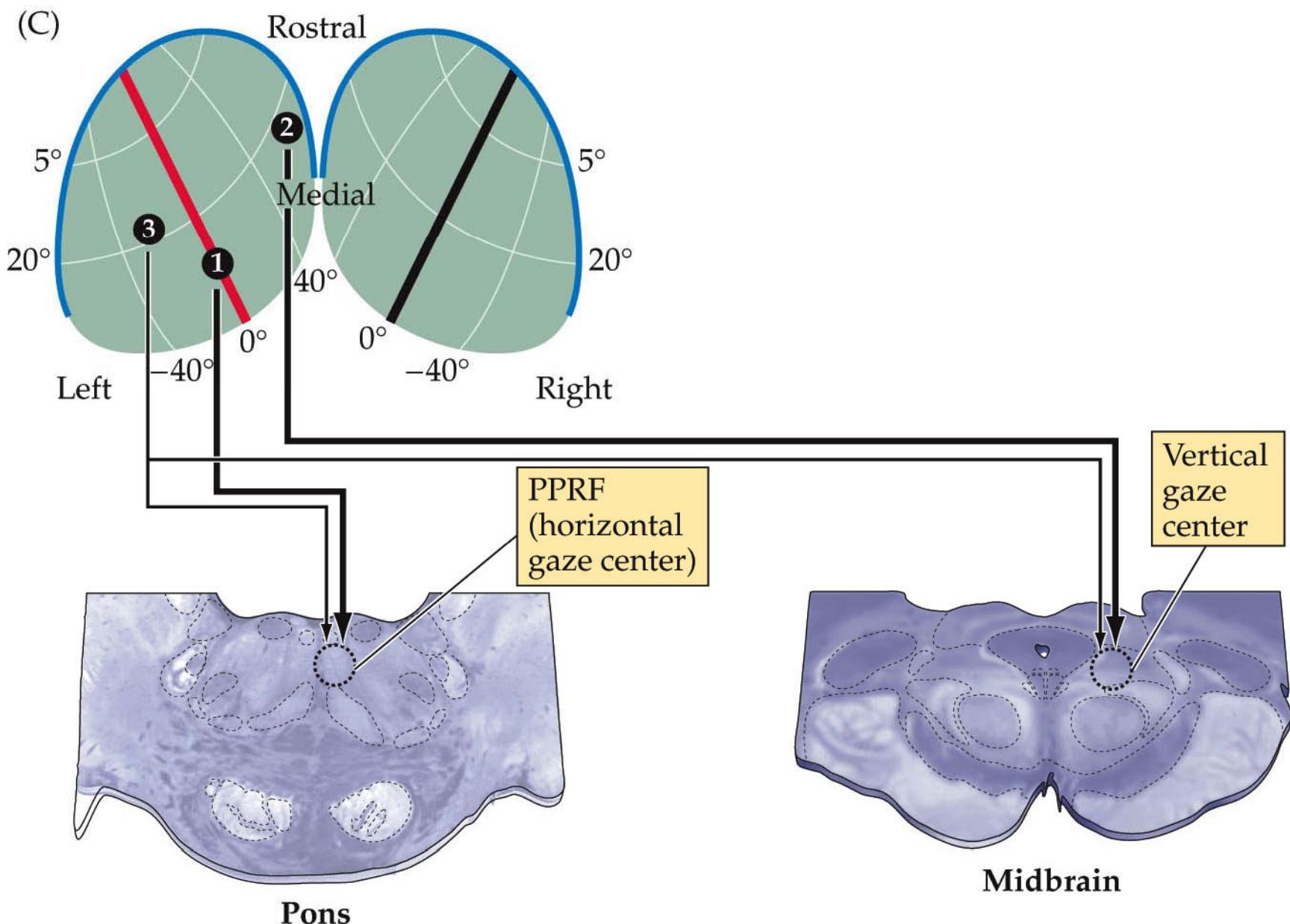
Important Local Circuits Within The Reticular Formation

- Gaze centers
- Cranial nerve reflexes

Figure 20.11 Projections from the frontal eye field to the superior colliculus and the PPRF



Box 20C(2) From Place Codes to Rate Codes (Part 1)



Reflexes

- Corneal blink
 - Input via 5
 - Output via 7
- Gag reflect
 - Input via 5 and 9
 - Output via 9
- Acoustic startle
 - Input via 8
 - Output via RF