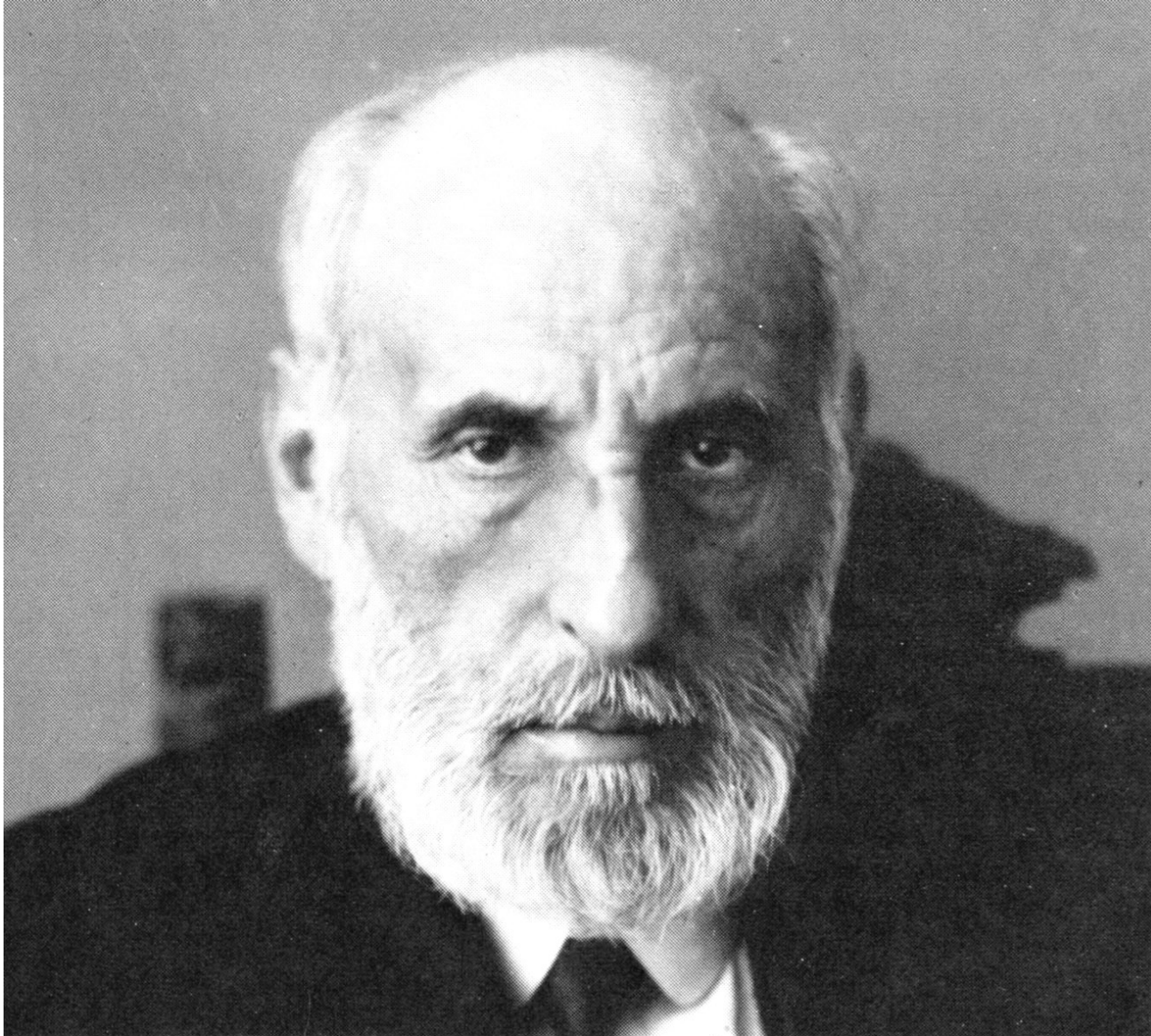


Emilio Golgi



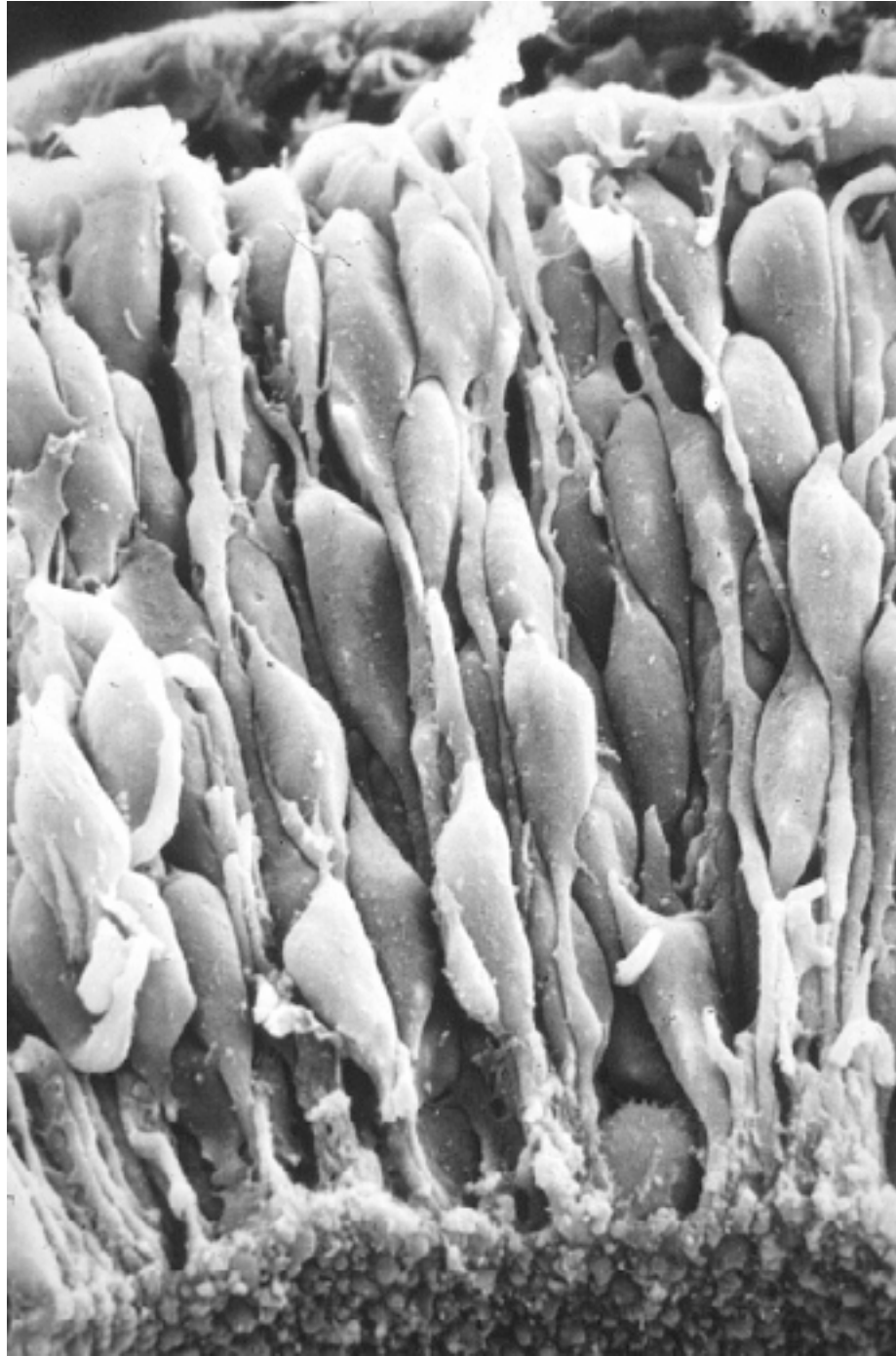
Santiago Ramon y Cajal



How to build a nervous system.

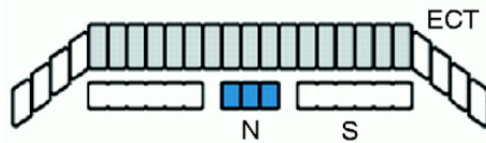
1. Cellular commitment to neural lineage.
2. Cell proliferation of neuroblasts and glioblasts.
3. Cellular migration.
4. Differentiation – neurons, astroglia (radial glia), oligodendroglia (myelination).
5. axonal outgrowth and synapse formation.
6. Cell death = apoptosis.

Cell Proliferation

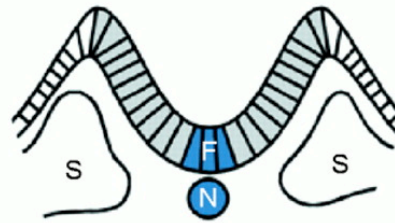


A Developmental stages

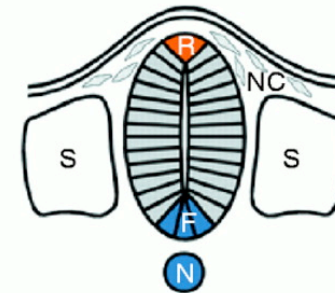
Neural plate



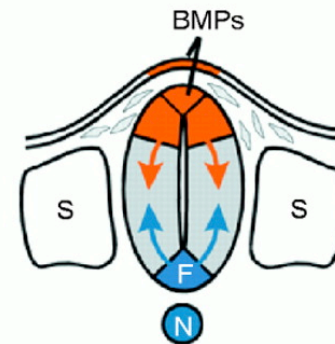
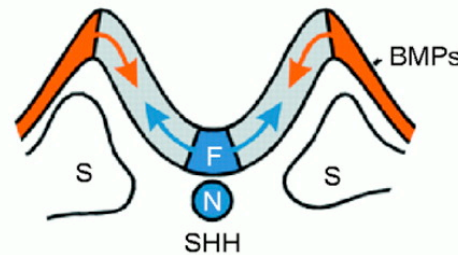
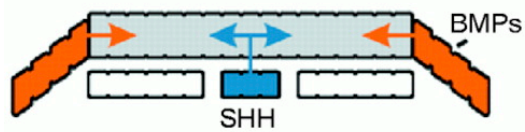
Neural fold



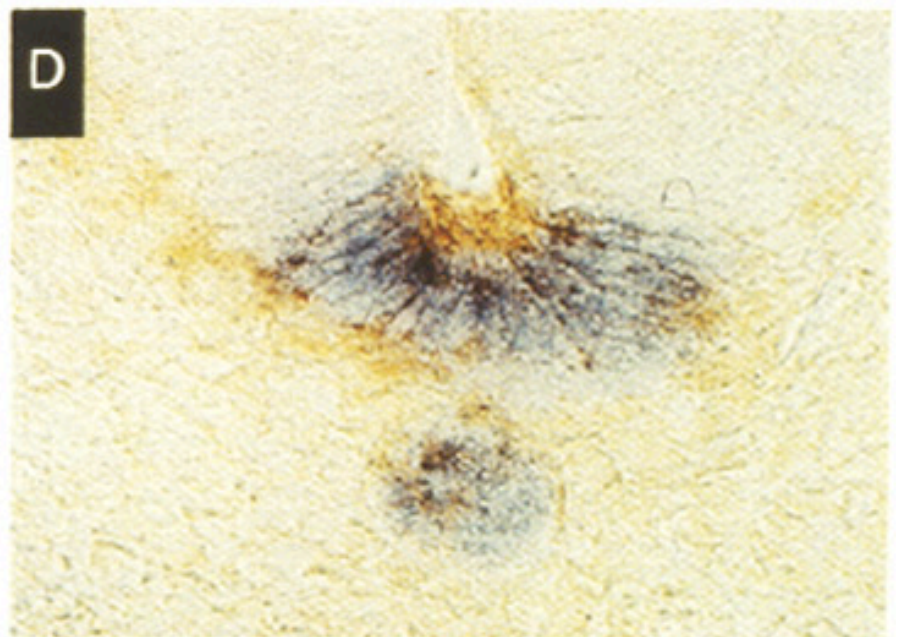
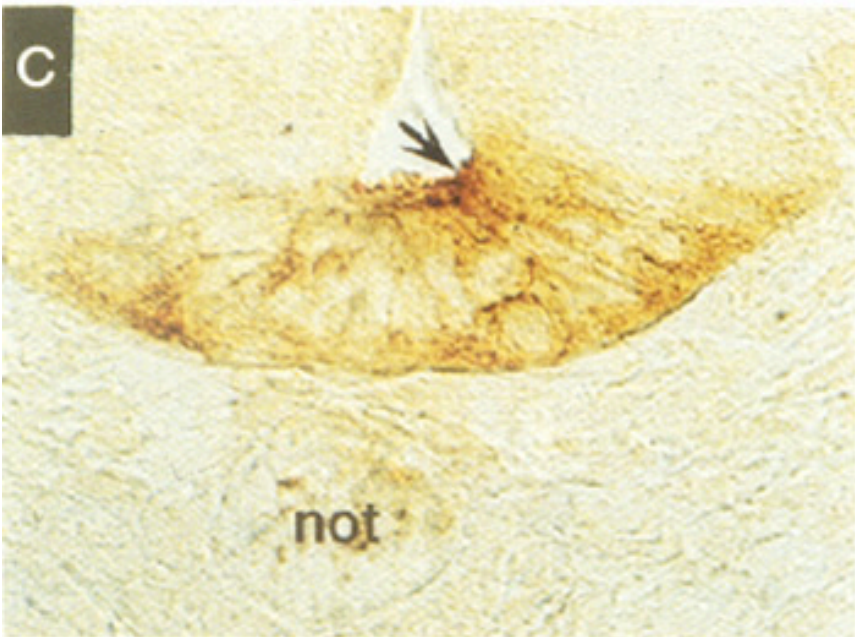
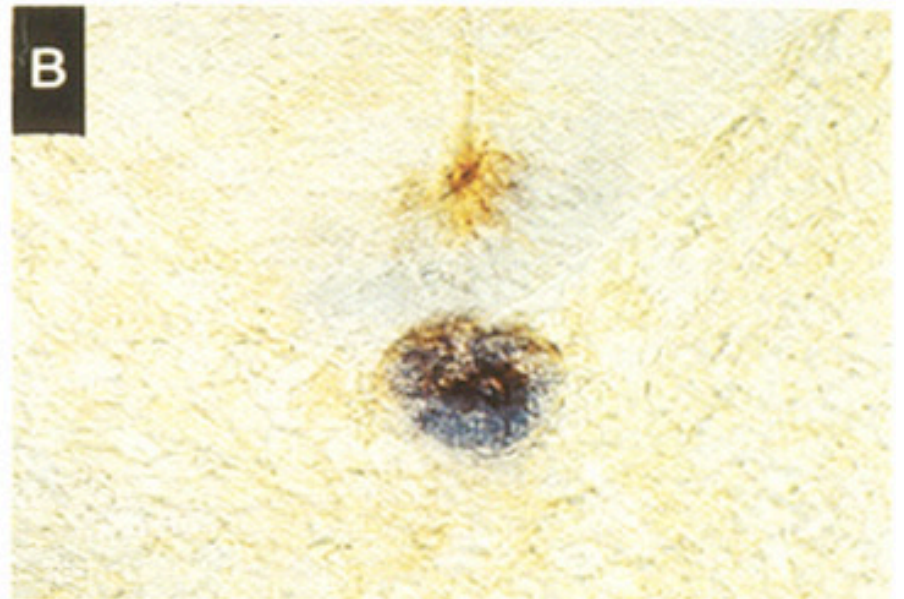
Neural tube

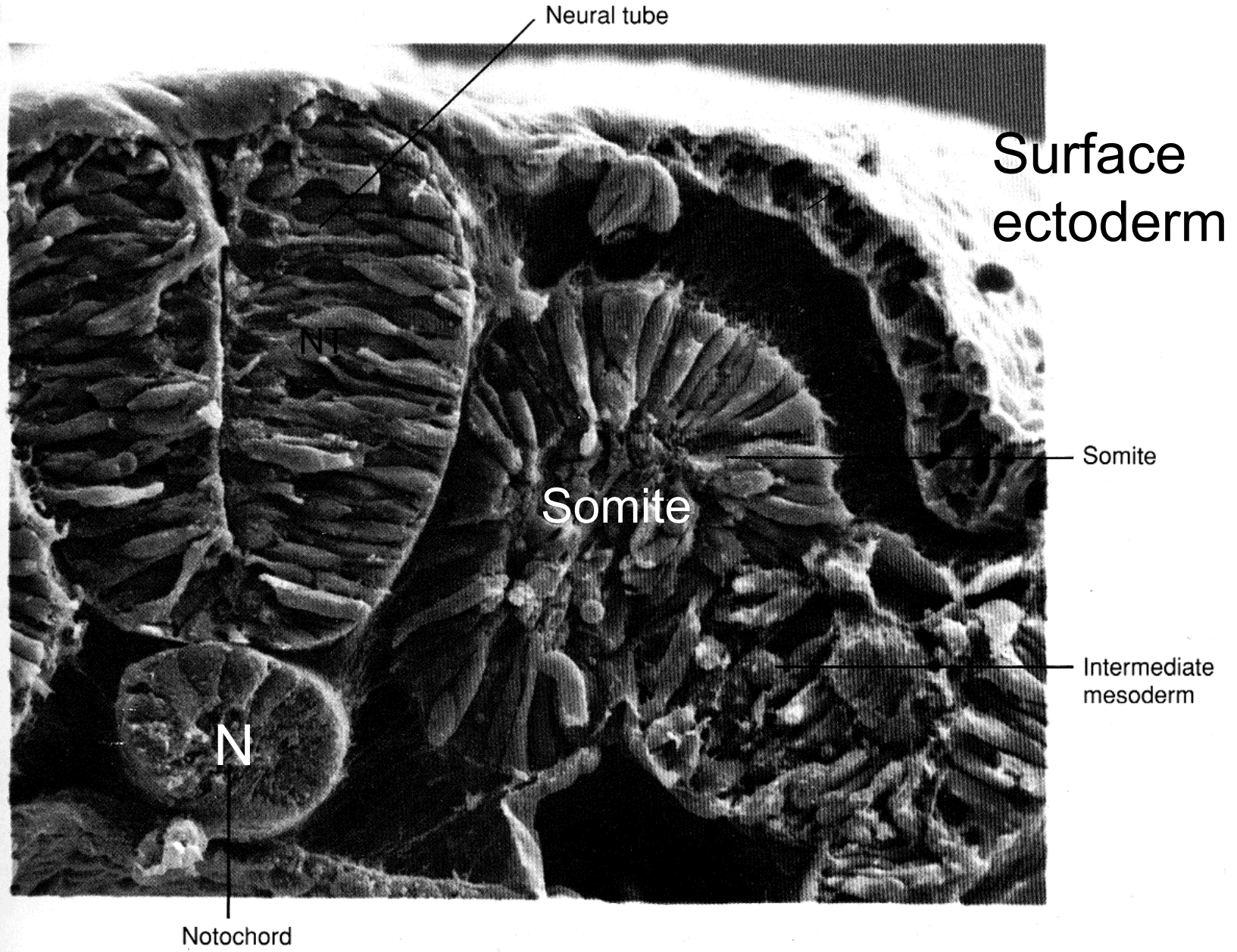


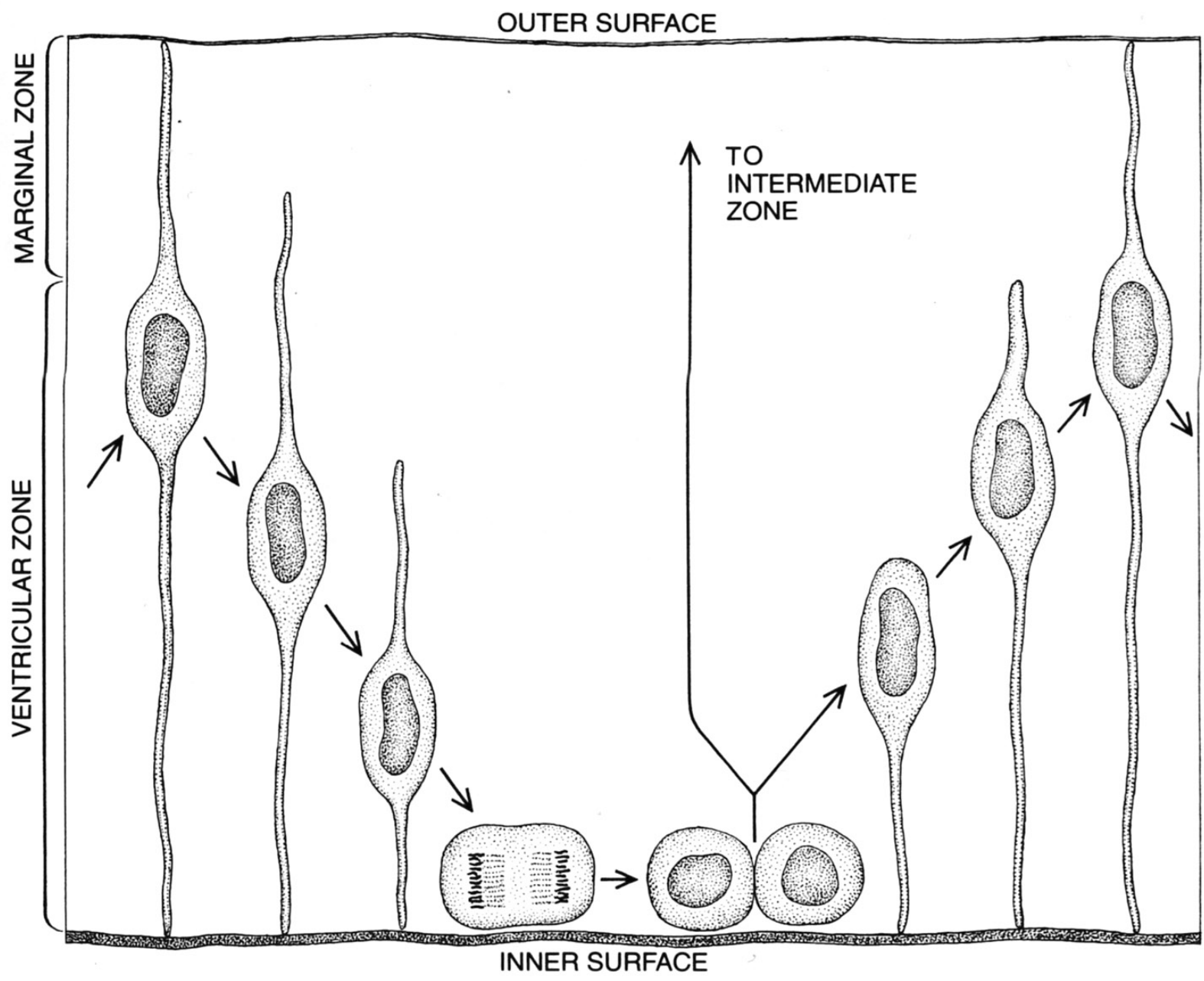
B Inductive signals

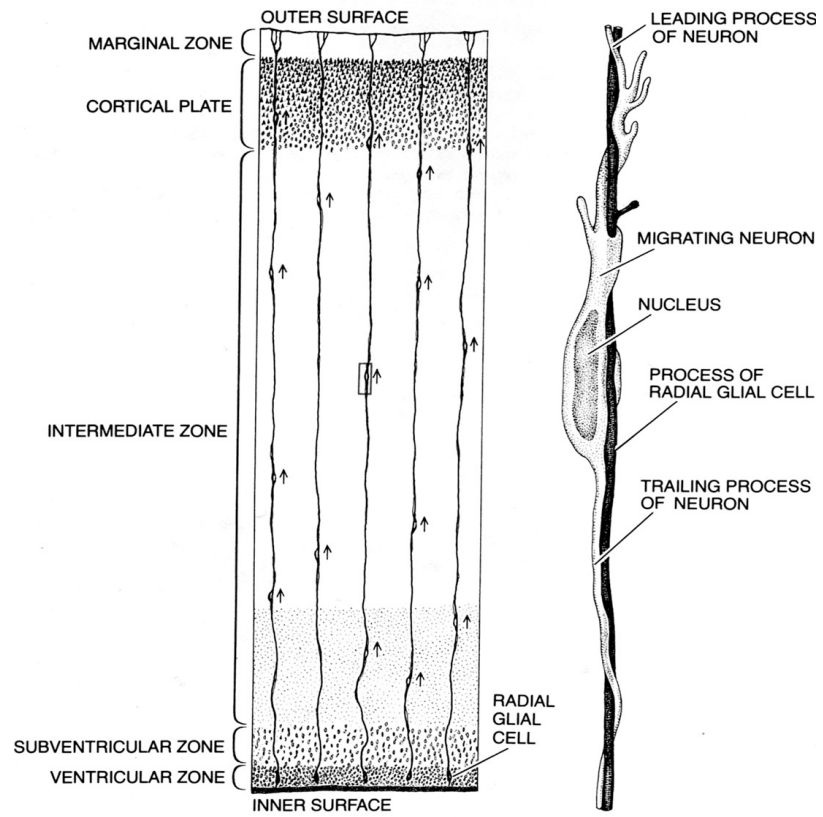
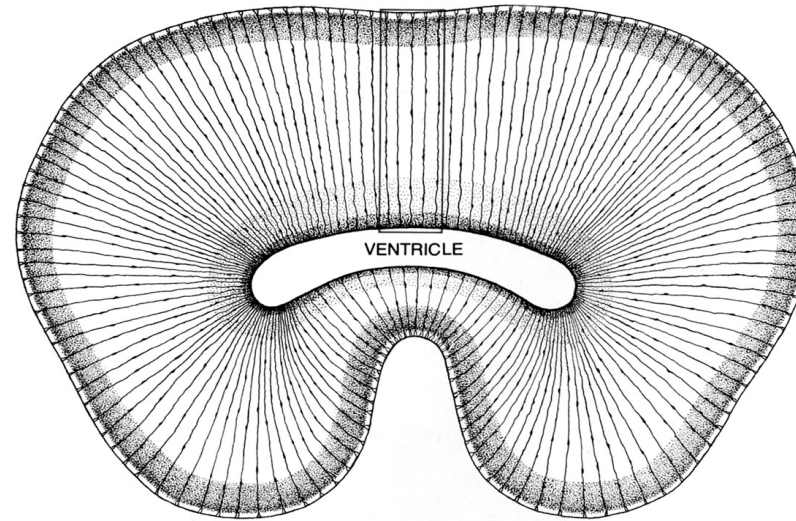


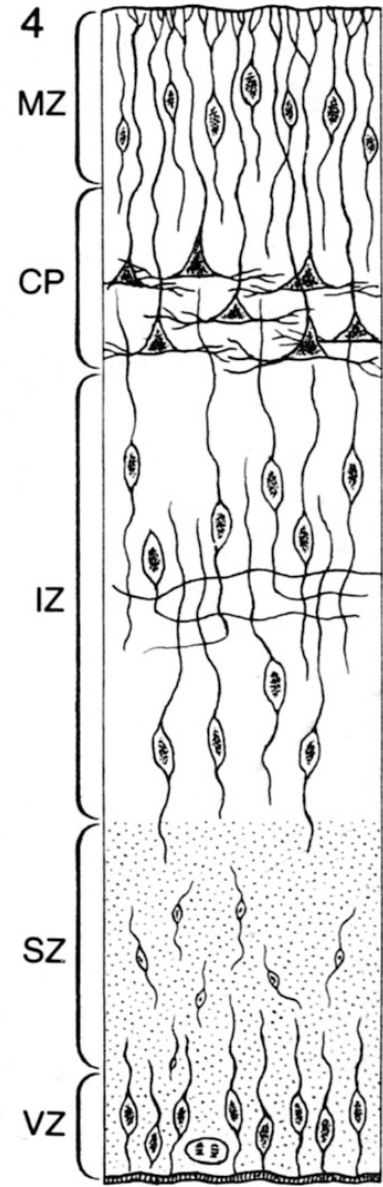
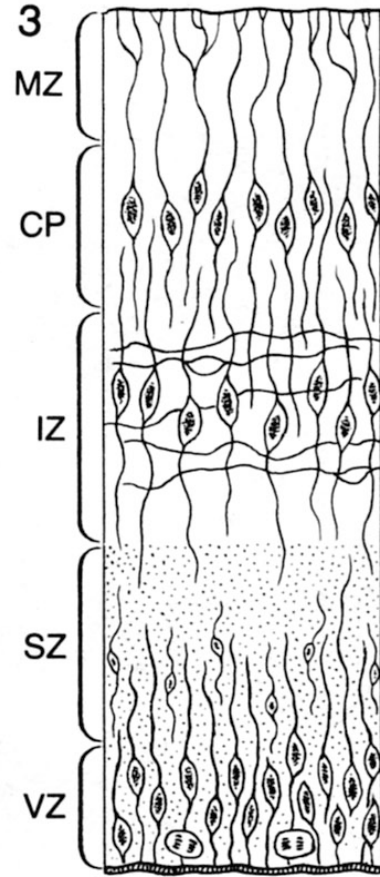
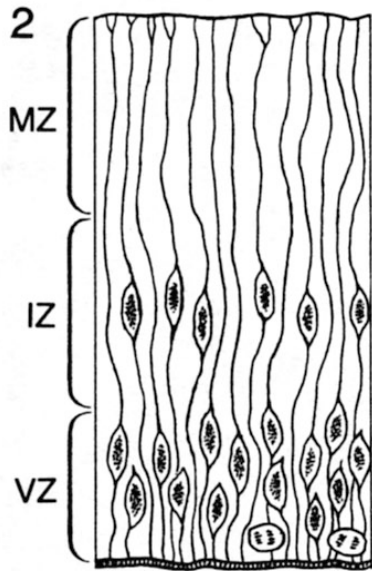
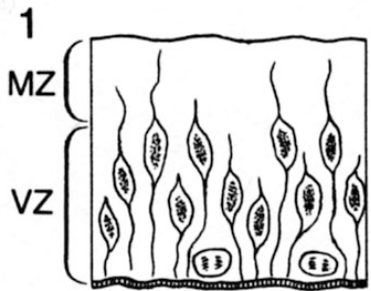
Y. Tanabe et al., *Science* 274, 1115 -1123 (1996)



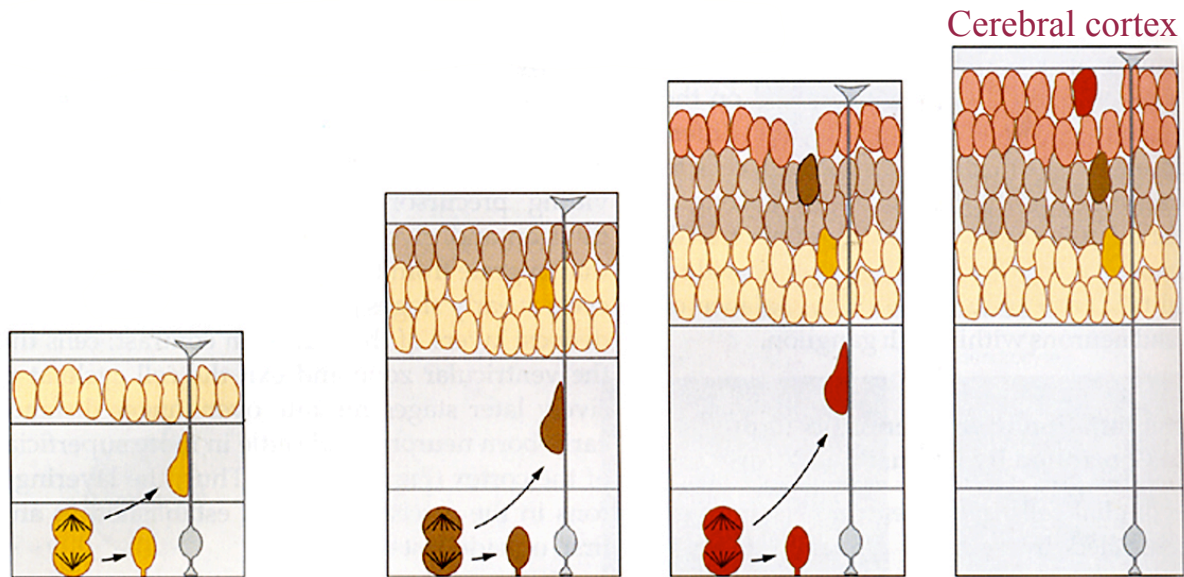




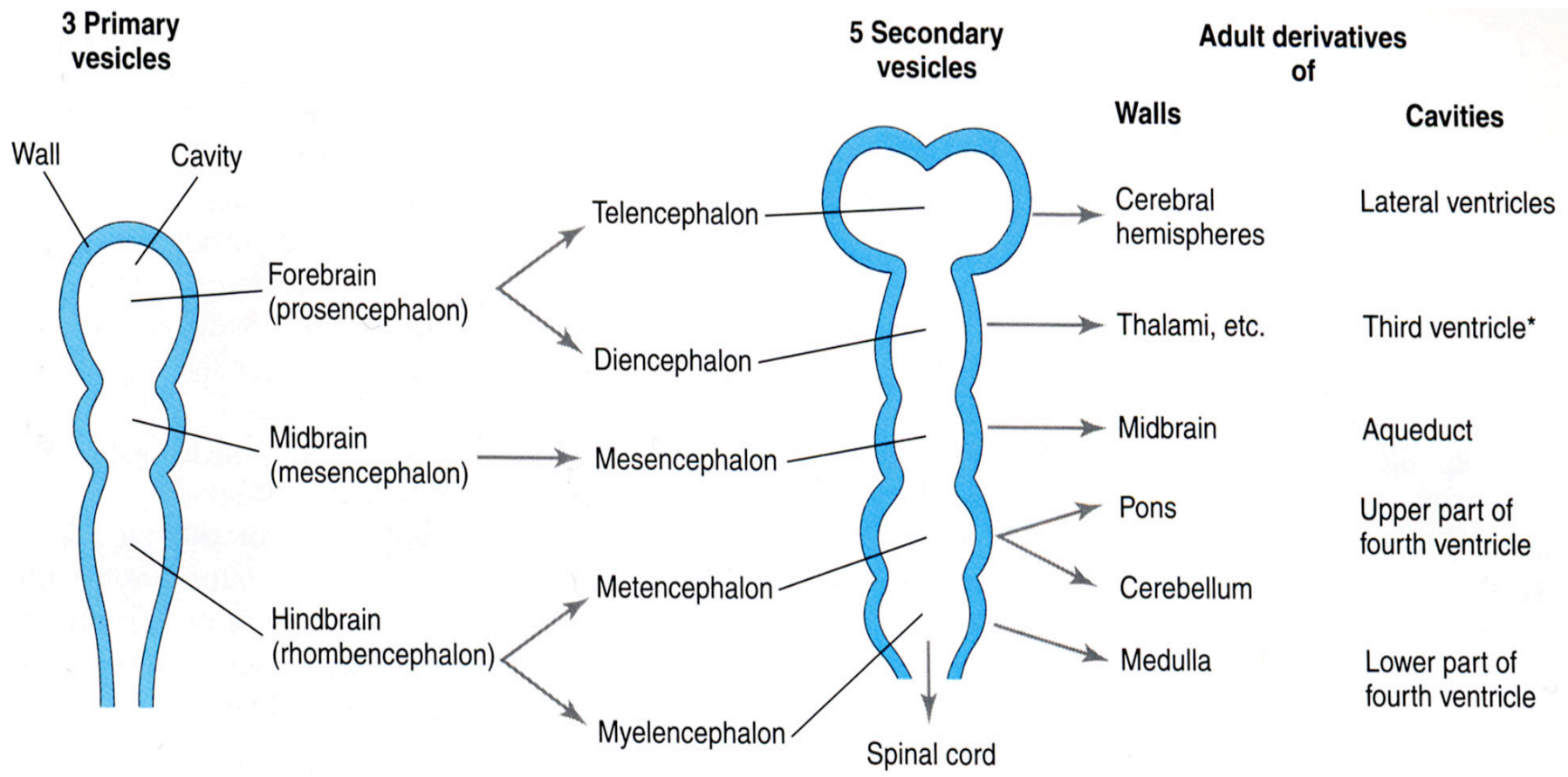


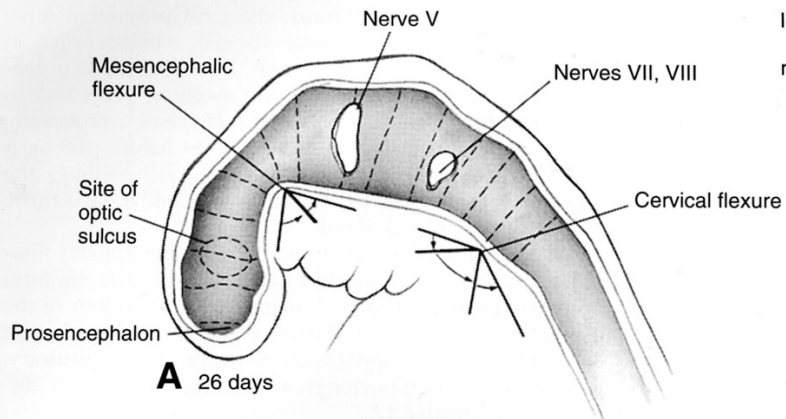


NEUROGENESIS IN THE CEREBRAL CORTEX



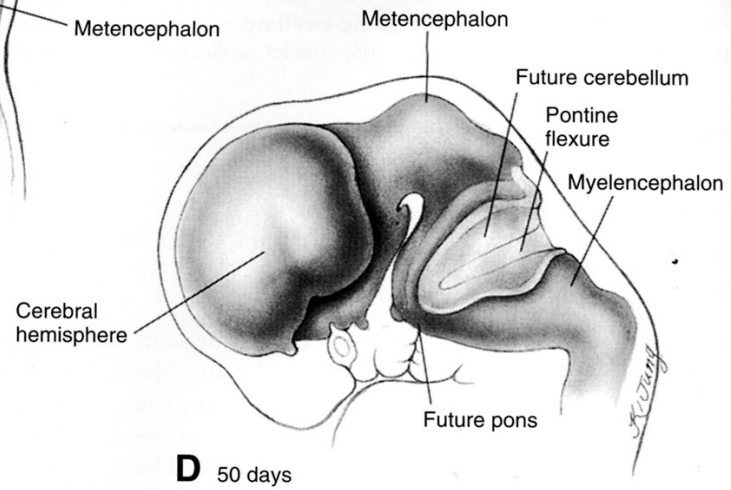
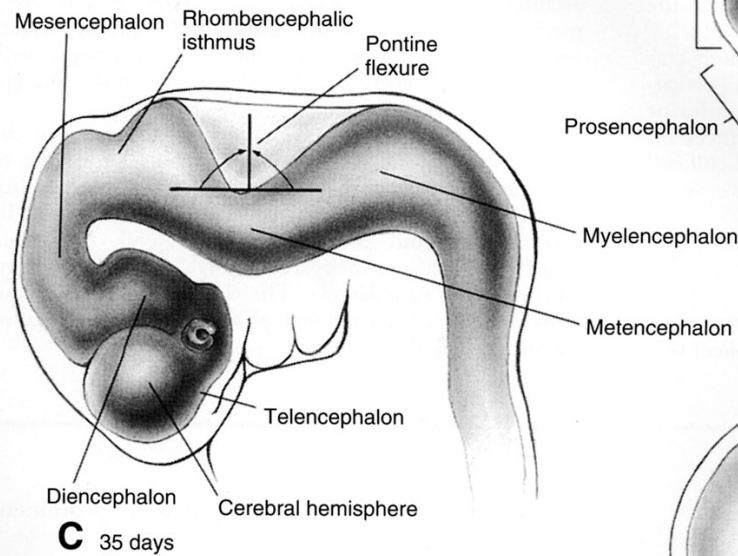
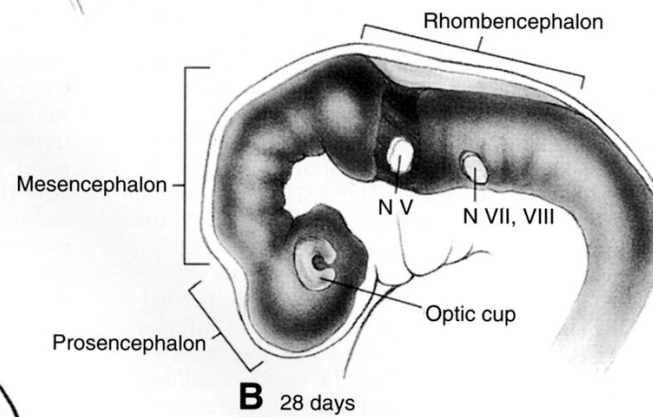
Neurons born at early stages migrate to the deepest layers of the cortical plate
Neurons born at later stages migrate form the more superficial layers of the cortex



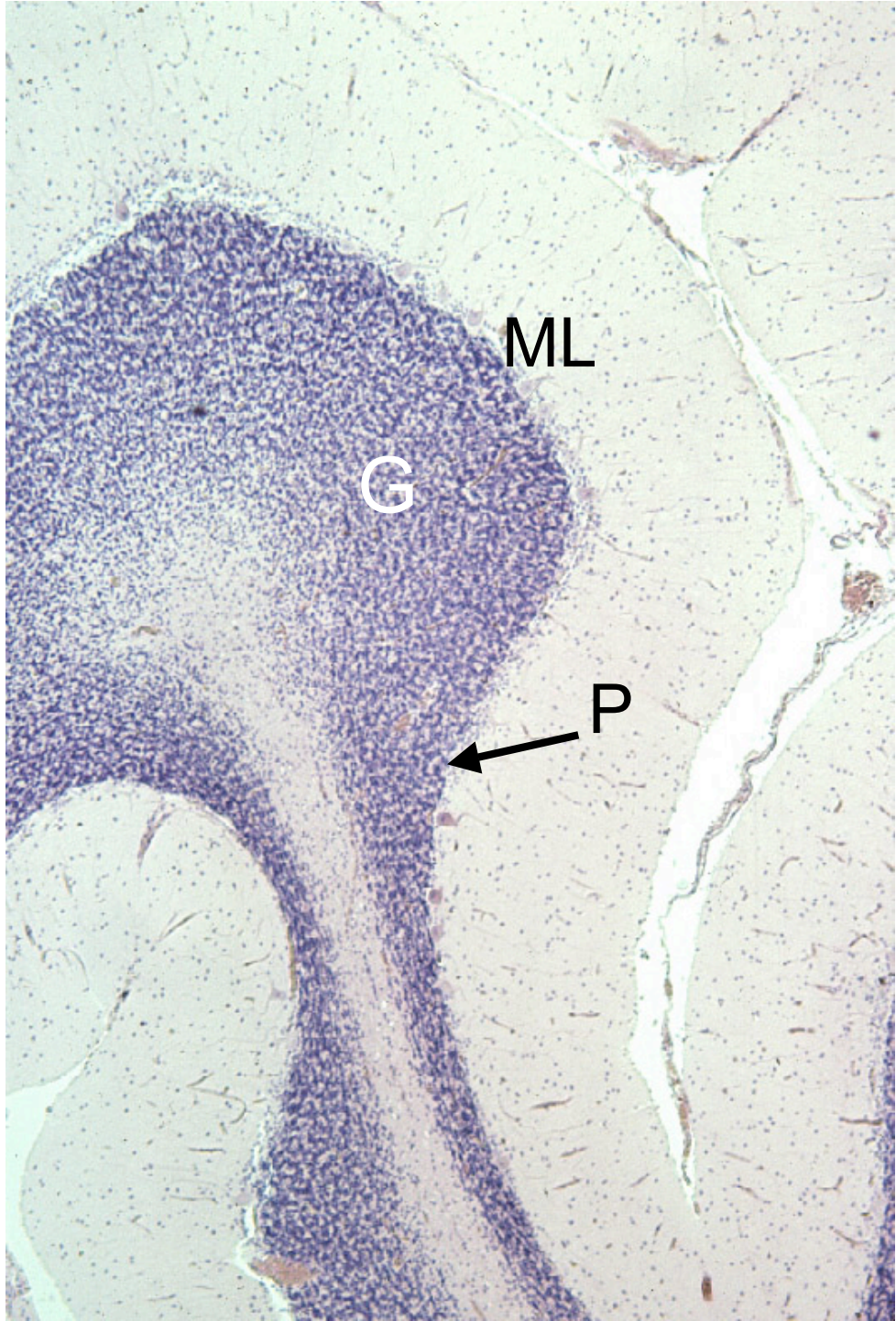


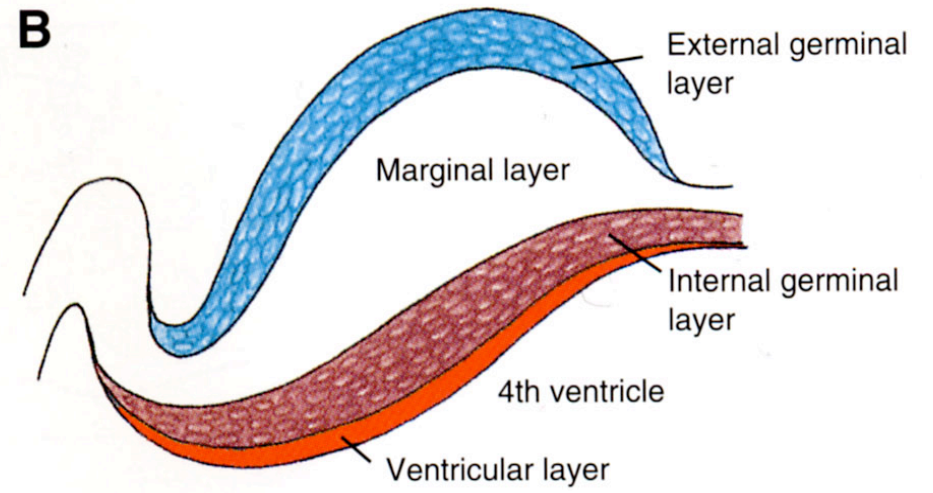
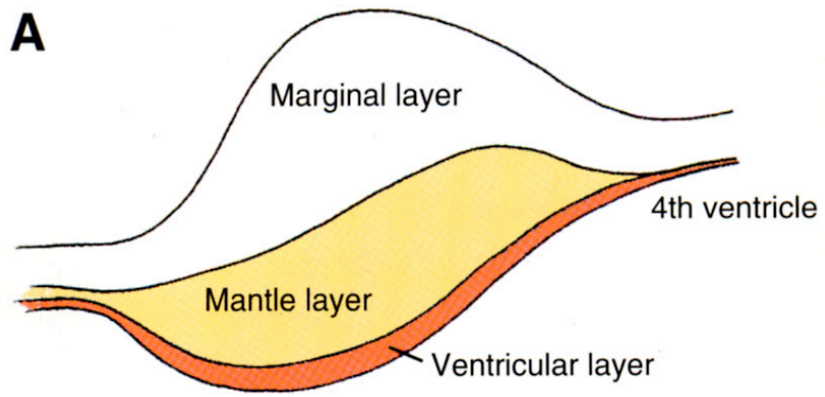
I: Isthmic neuromere

r1-r7: rhombomeres 1-7

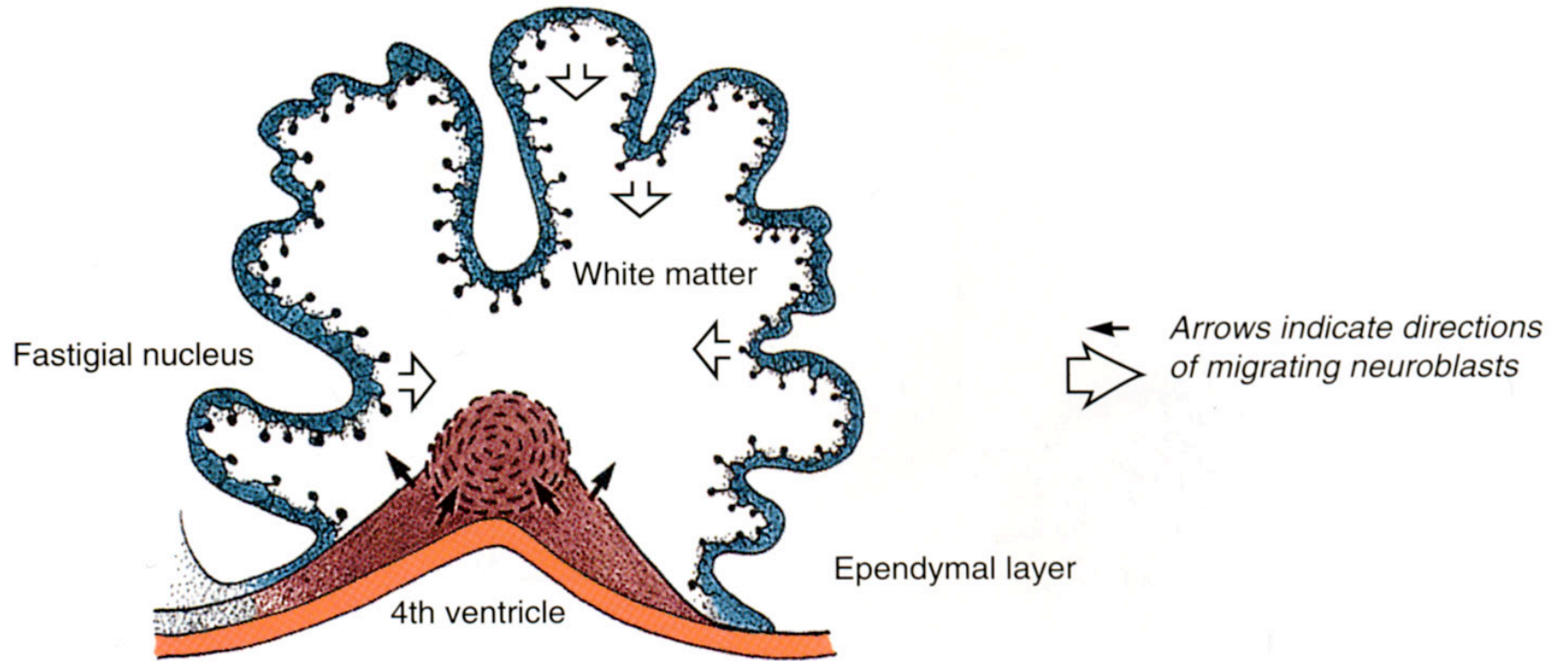


Cerebellum is generated by two
regions of mitotic cells

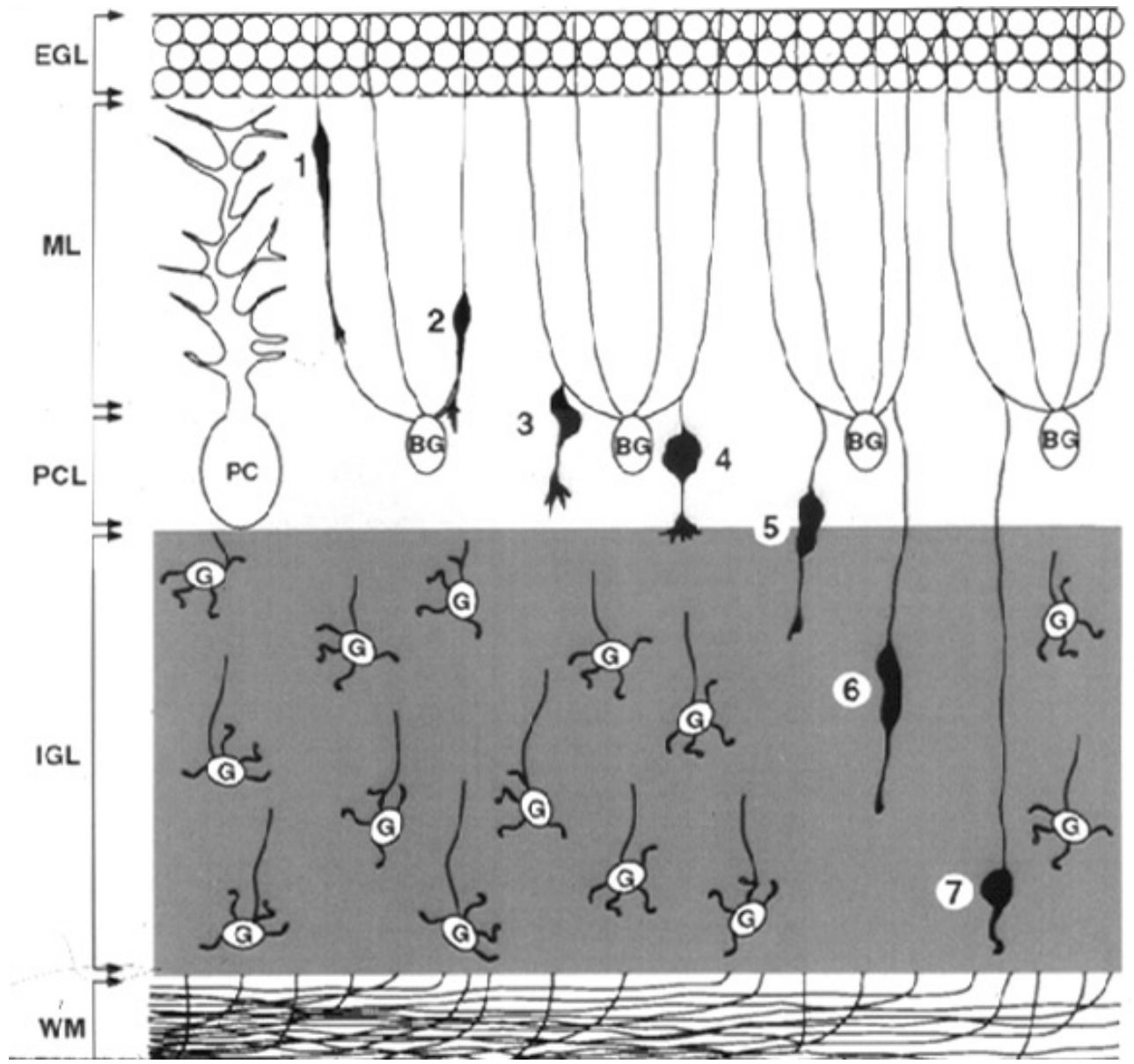




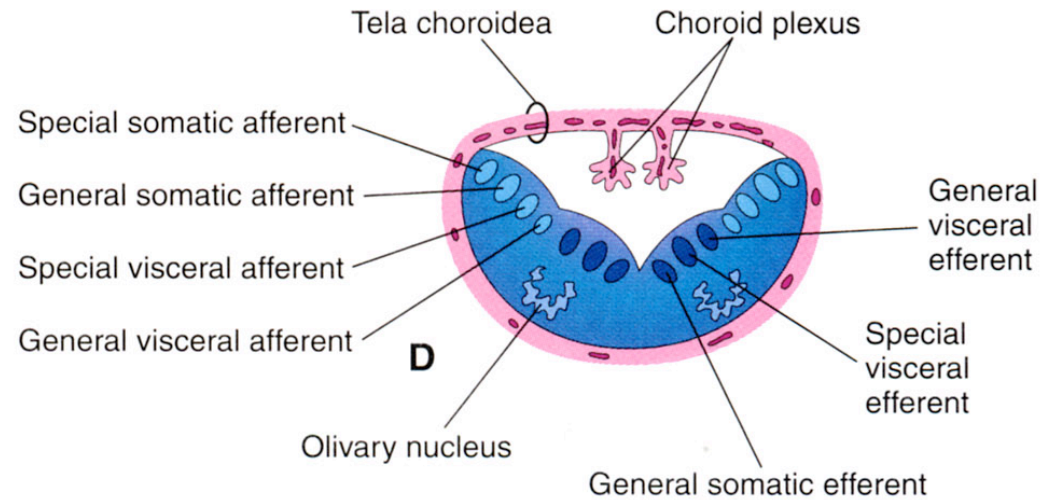
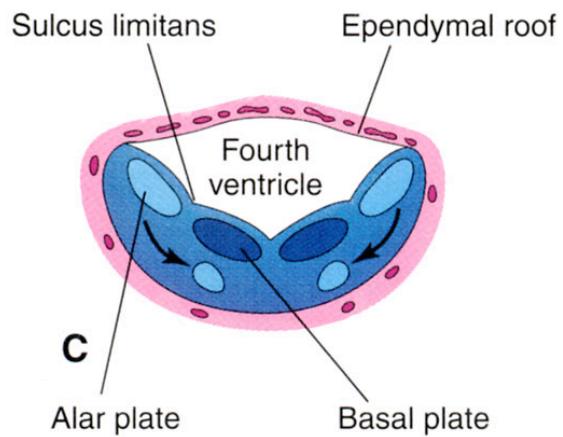
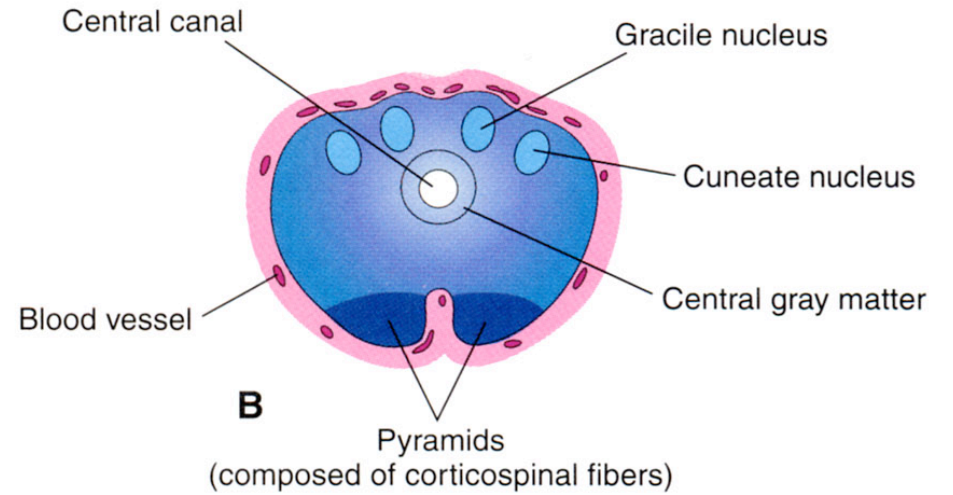
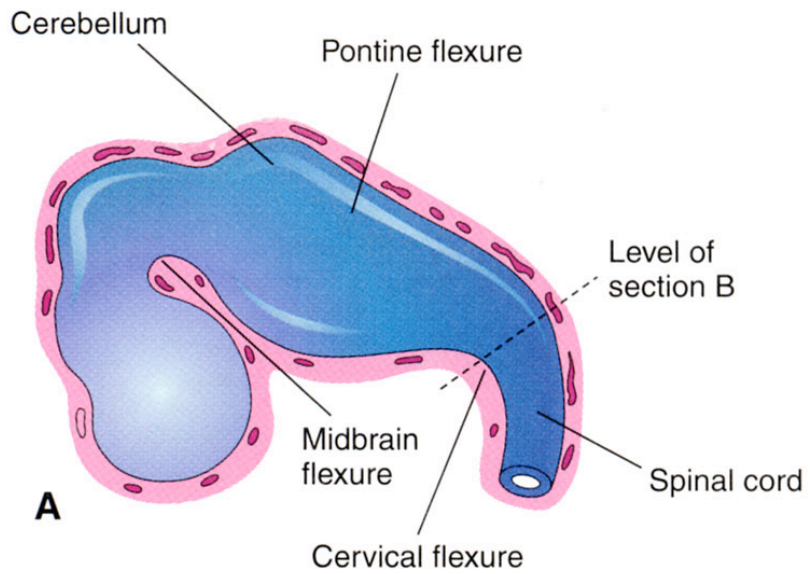
C

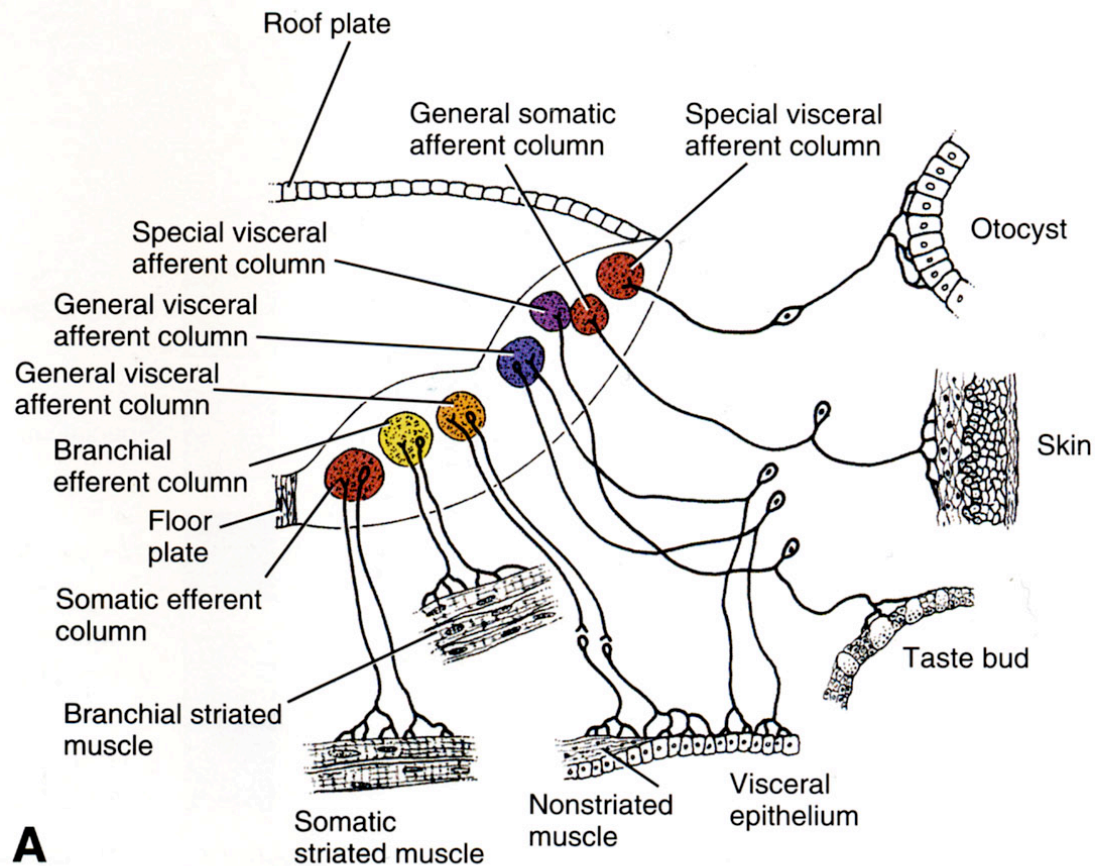


D



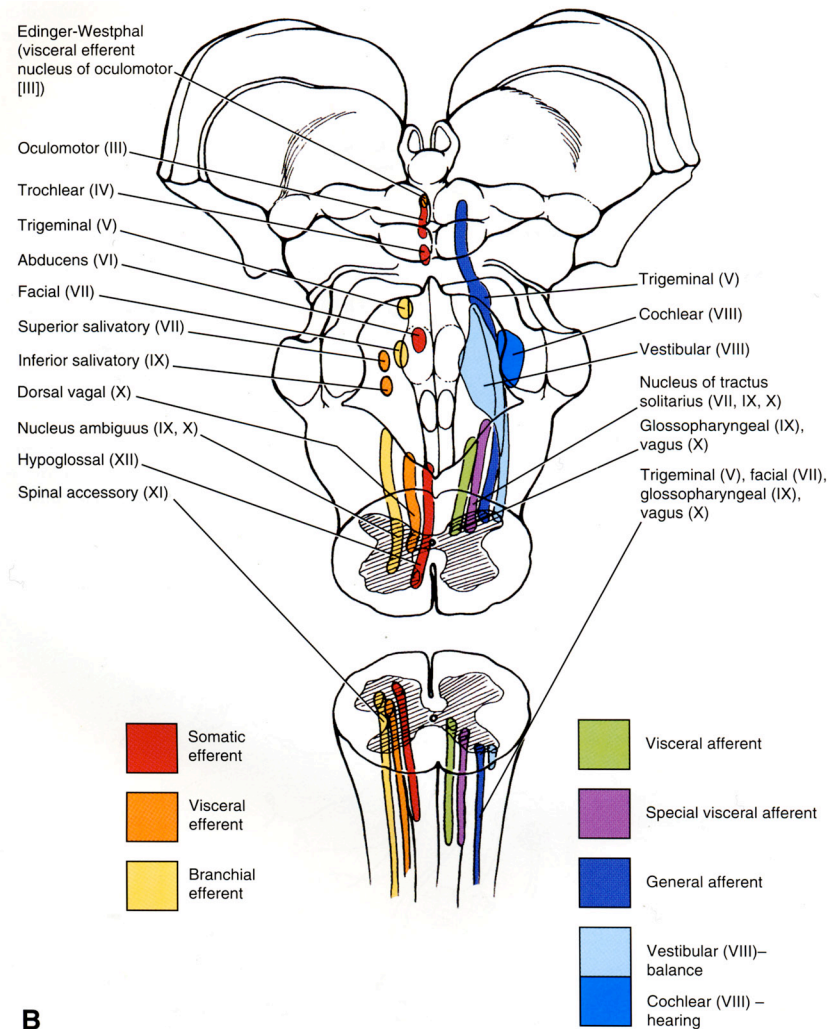
Organization of rhombencephalon





A

Figure 13-3. Organization of the brain stem cranial nerve nuclei. The basal columns give rise to motor (efferent) cranial nerve nuclei and the alar columns to associational (afferent) cranial nerve nuclei. These nuclei can be grouped into seven discontinuous columns, each subserving a specific type of function. A, Idealized organization of the brain stem cranial nerve nuclei into seven columns.



B
Figure 13-3. *Continued.* *B*, View of the brain stem showing the locations of the cranial nerve nuclei making up the seven columns. The efferent nuclei are shown on the left and the afferent nuclei on the right. (*A*, Modified from Williams PL, Warwick R, Dyson M, Bannister LH. 1989. *Gray's Anatomy*. Churchill Livingstone, Edinburgh.)

Table 13–1
Location of the Cranial Nerve Nuclei

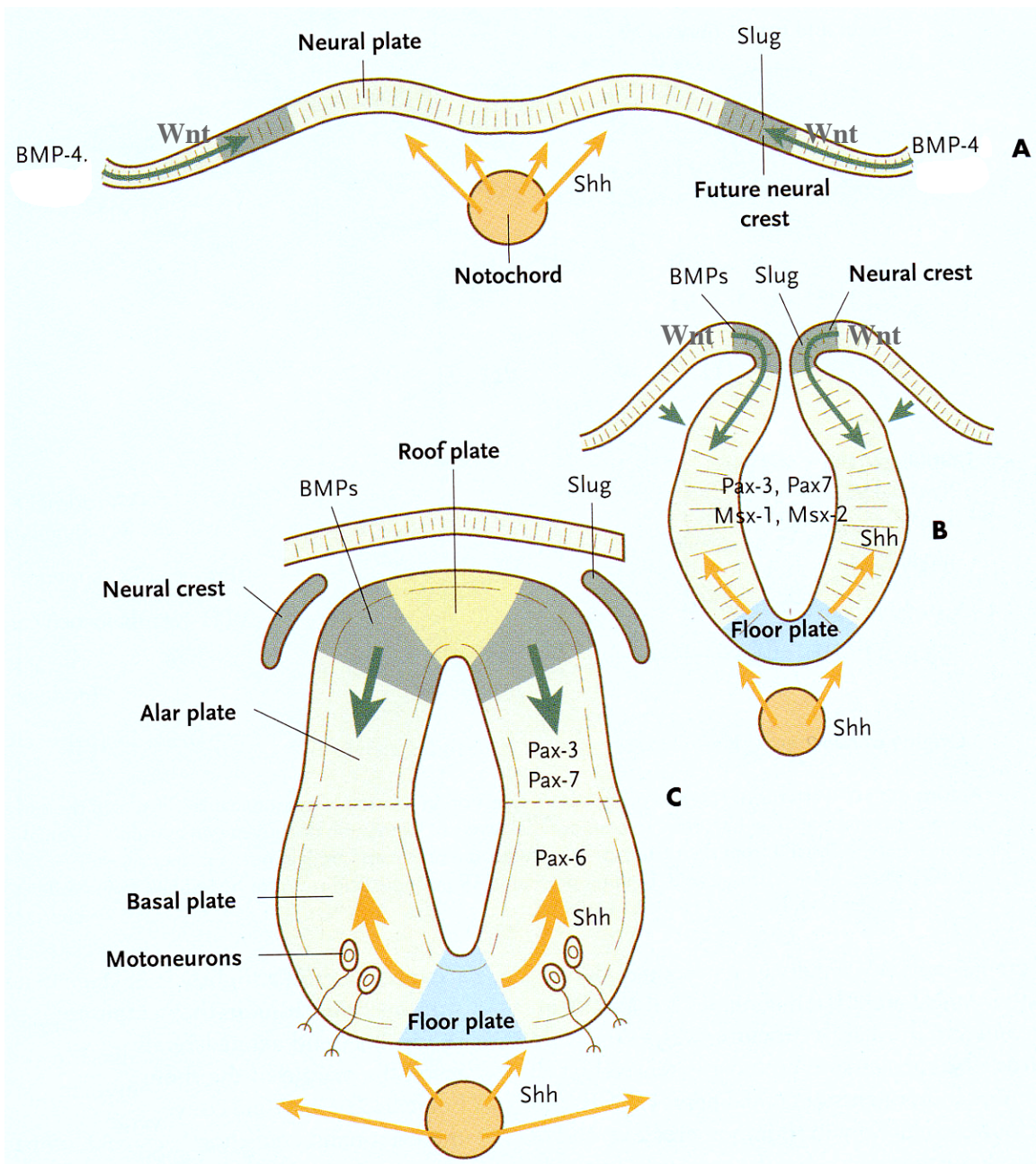
BRAIN REGION	ASSOCIATED CRANIAL NERVES
Telencephalon	Olfactory (I)
Diencephalon	Optic (II)
Mesencephalon	Oculomotor (III)
Metencephalon	Trochlear (IV) (Arises in the metencephalon but is later displaced into the mesencephalon)
	Trigeminal (V) (The trigeminal sensory nuclei arise in the metencephalon and myelencephalon but are later displaced partly into the mesencephalon. The trigeminal motor nucleus arises in the metencephalon and remains there.)
	Abducens (VI)
	Facial (VII)
	Vestibulocochlear (VIII)
Myelencephalon	Glossopharyngeal (IX)
	Vagus (X)
	Accessory (XI)
	Hypoglossal (XII)

Table 13–2

Origins of the Neurons in the Cranial Nerve Ganglia

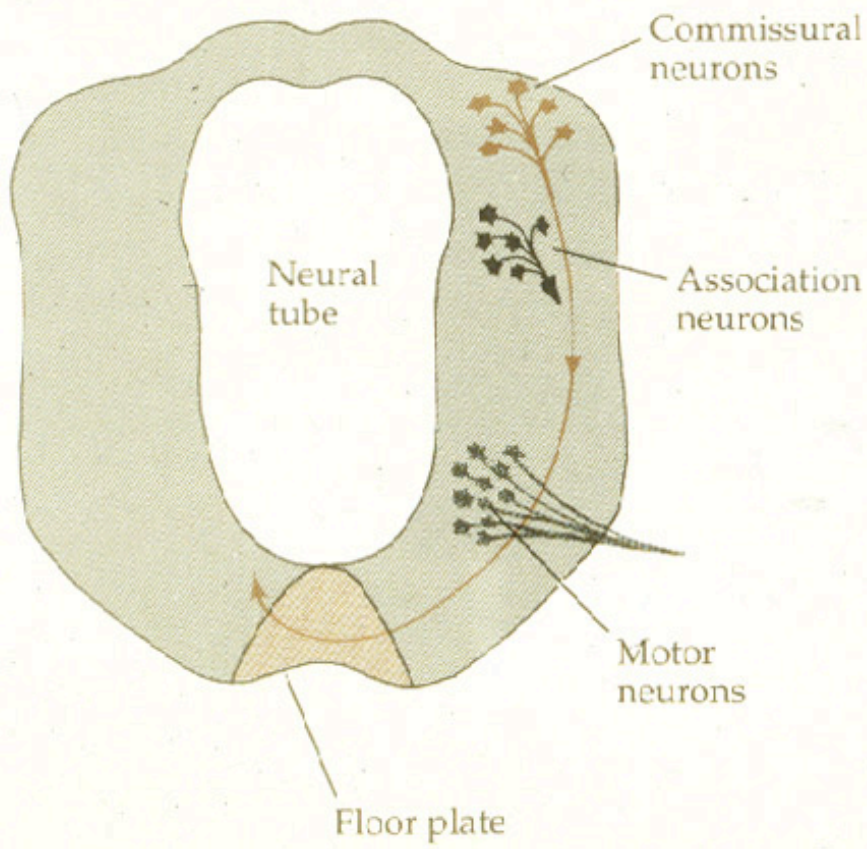
CRANIAL NERVE	GANGLION AND TYPE	ORIGIN OF NEURONS
Olfactory (I)	Olfactory epithelium (primary neurons of the olfactory pathway) (special afferent)	Nasal placode
Oculomotor (III)	Ciliary ganglion (visceral efferent)	Neural crest of the caudal diencephalon and cranial mesencephalon
Trigeminal (V)	Trigeminal ganglion (general afferent)	Neural crest of the caudal diencephalon and cranial mesencephalon; trigeminal placode
Facial (VII)	Superior ganglion of nerve VII (general and special afferent)	Rhombencephalic neural crest; 1st epibranchial placode
	Inferior (geniculate) ganglion of nerve VII (general and special afferent)	1st epibranchial placode
	Sphenopalatine ganglion (visceral efferent)	Rhombencephalic neural crest
Vestibulocochlear (VIII)	Submandibular ganglion (visceral efferent)	Rhombencephalic neural crest
	Acoustic (cochlear) ganglion (special afferent)	Otic placode
	Vestibular ganglion (special afferent)	Otic placode plus some contribution from neural crest
Glossopharyngeal (IX)	Superior ganglion (general and special afferent)	Rhombencephalic neural crest
	Inferior (petrosal) ganglion (general and special afferent)	2nd epibranchial placodes
	Otic ganglion (visceral efferent)	Rhombencephalic neural crest
Vagus (X)	Superior ganglion (general afferent)	Rhombencephalic neural crest
	Inferior (nodose) ganglion (general and special afferent)	3rd and 4th epibranchial placodes
	Vagal parasympathetic (enteric) ganglia (visceral efferent)	Rhombencephalic neural crest

Neuronal differentiation:
Example – spinal cord.

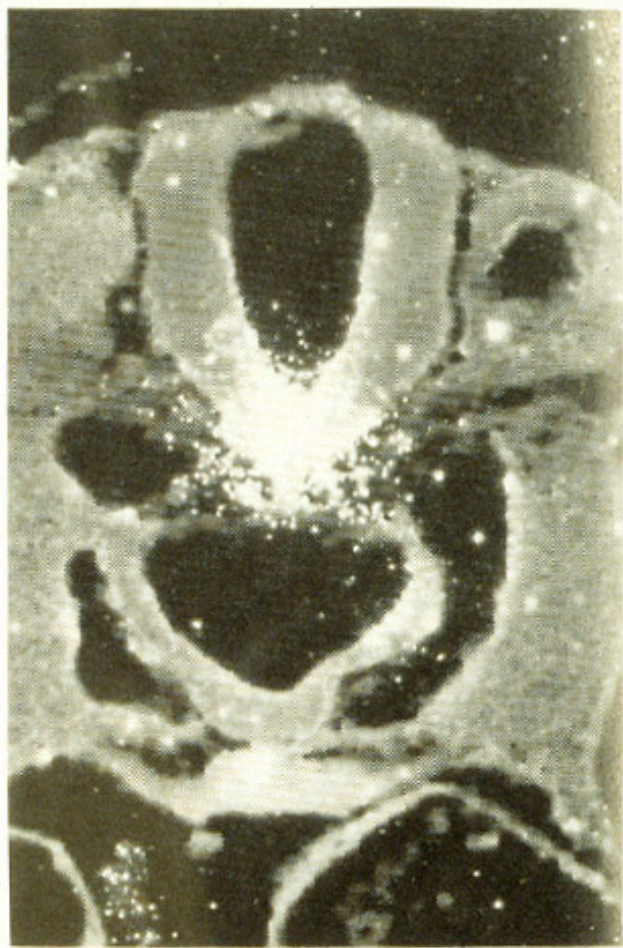


(A)

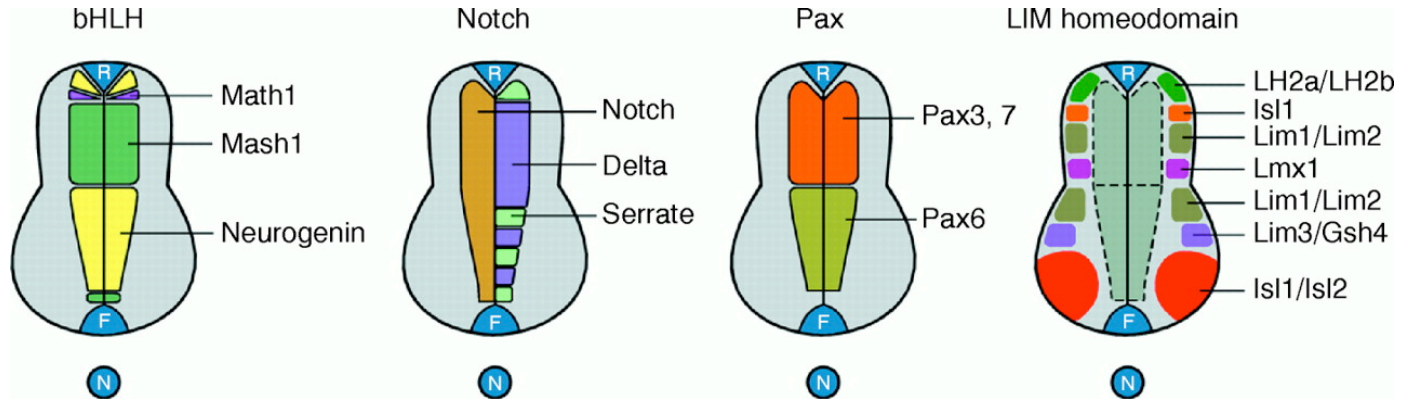
Spinal cord root



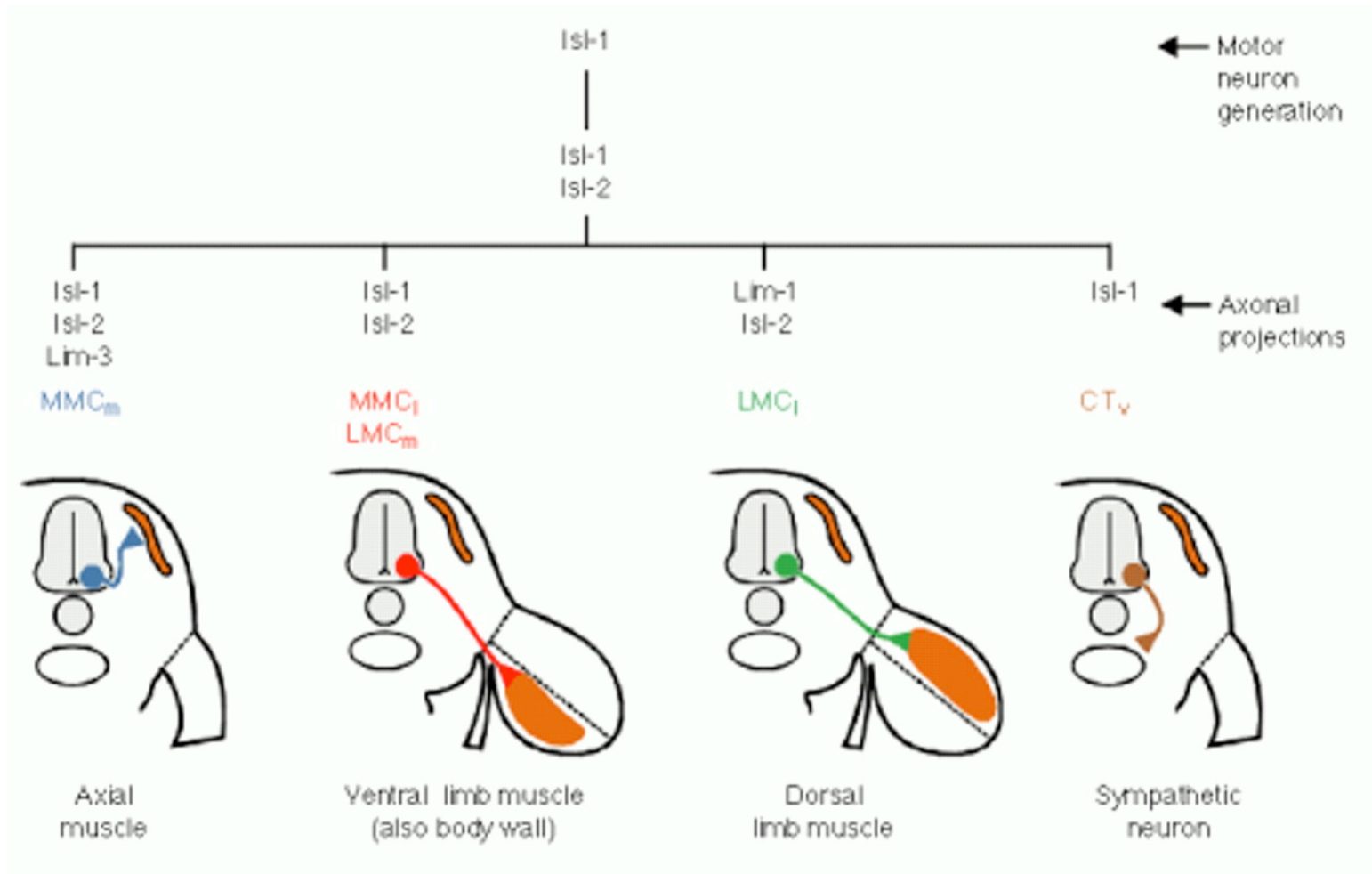
(B)



No Caption Found

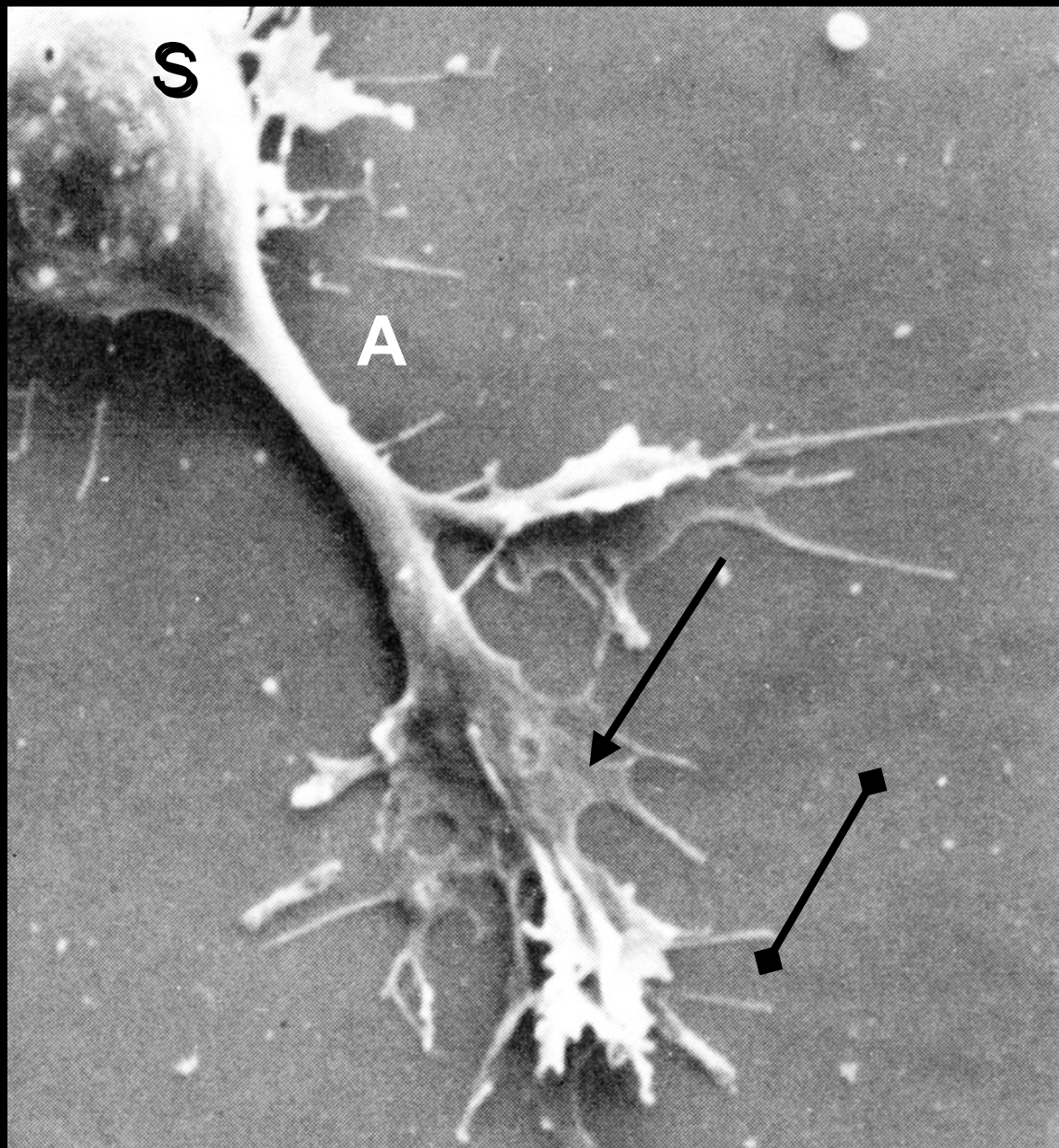


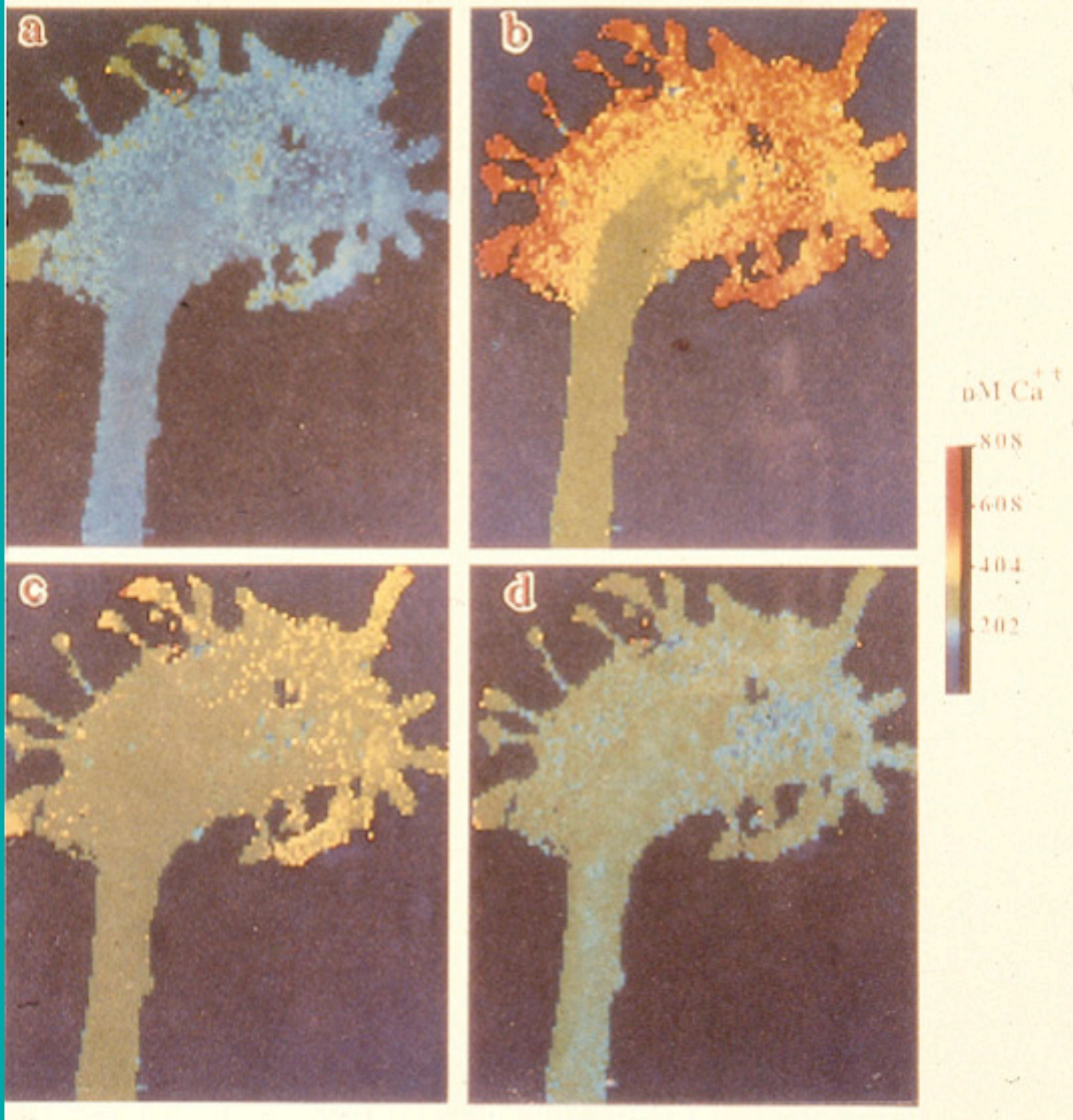
Y. Tanabe et al., Science 274, 1115 -1123 (1996)



Y. Tanabe et al., *Science* 274, 1115 -1123 (1996)

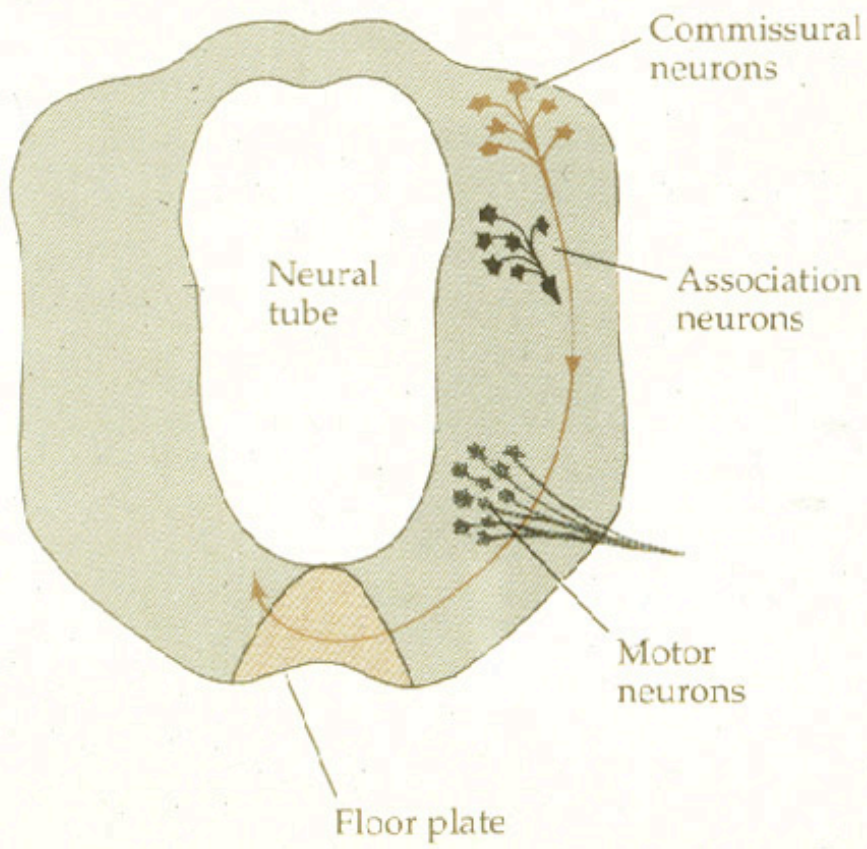
Neuronal polarity & axonal outgrowth





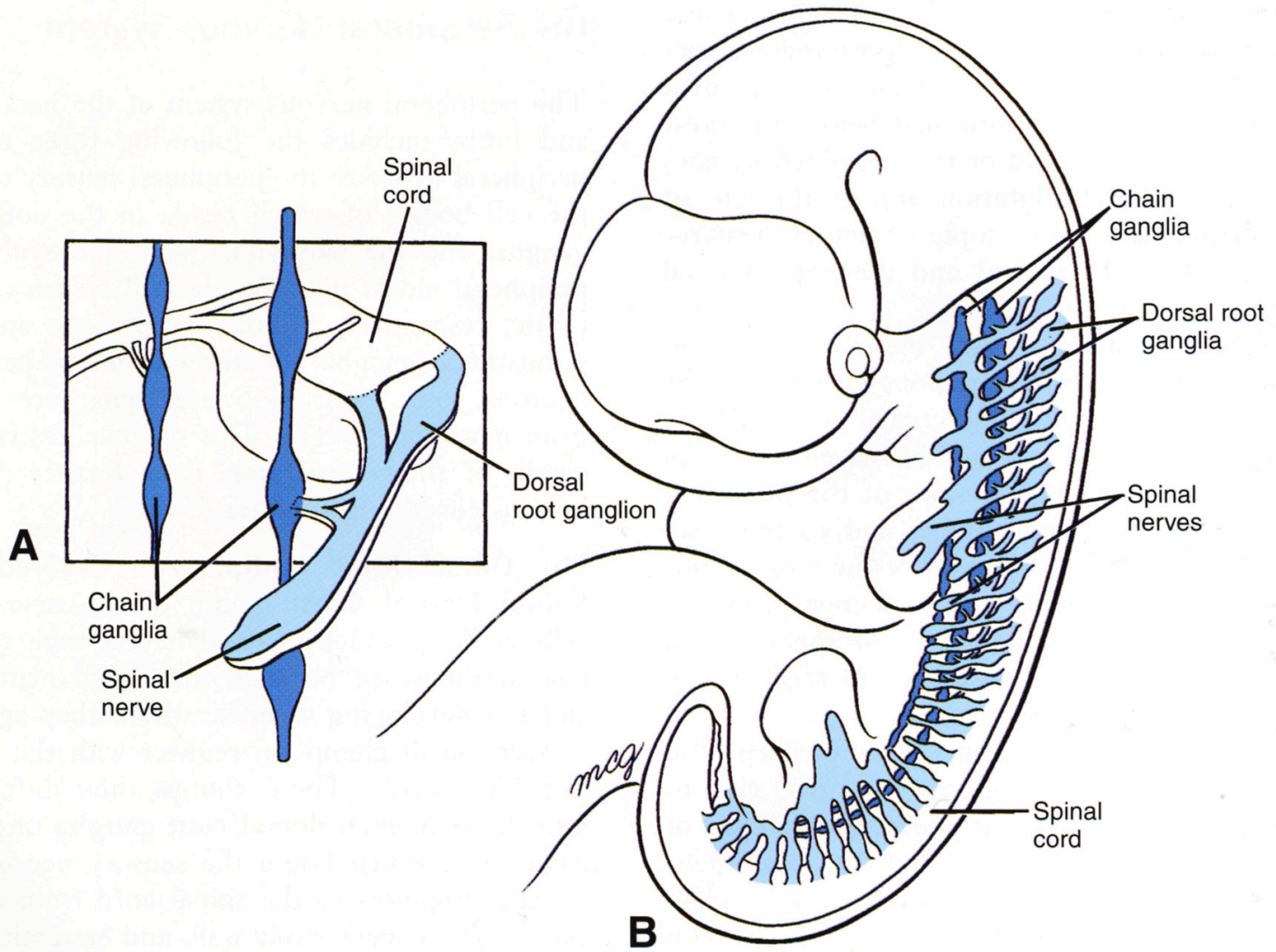
(A)

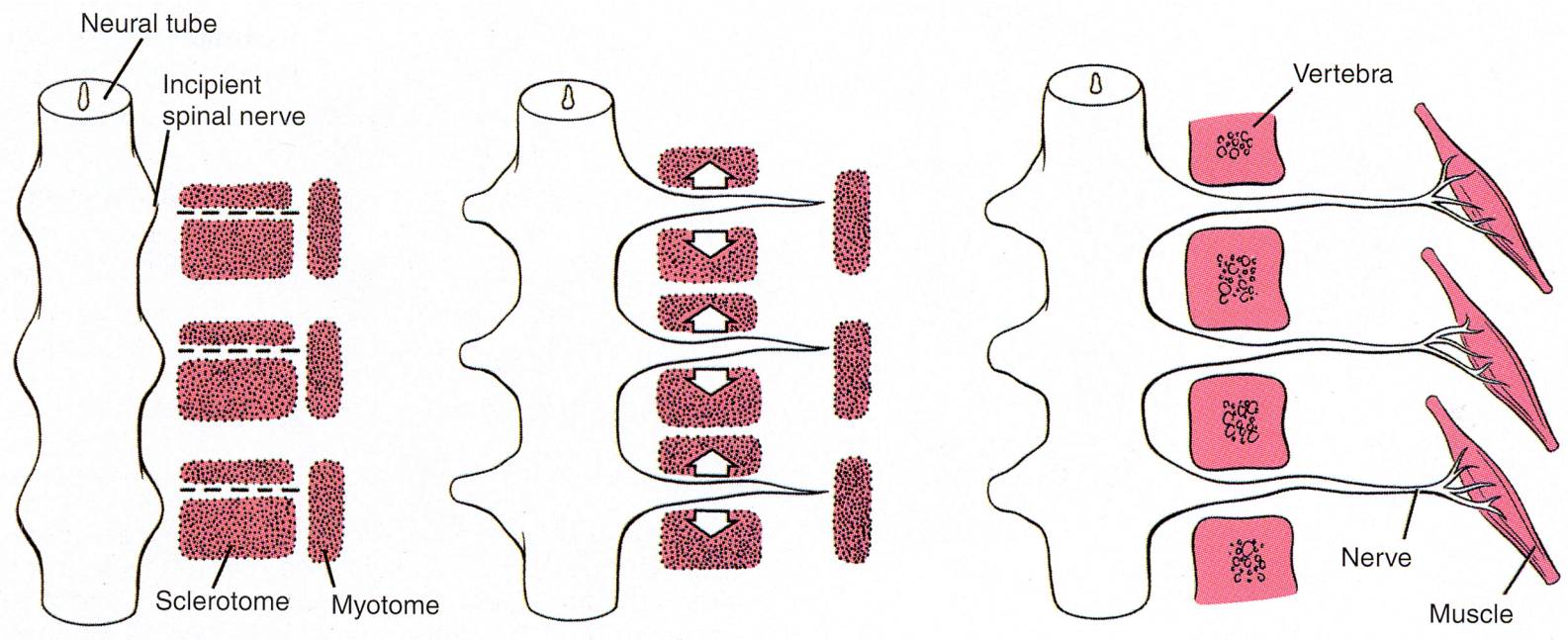
Spinal cord root



(B)







Neuronal death

Programmed cell death by apoptosis

