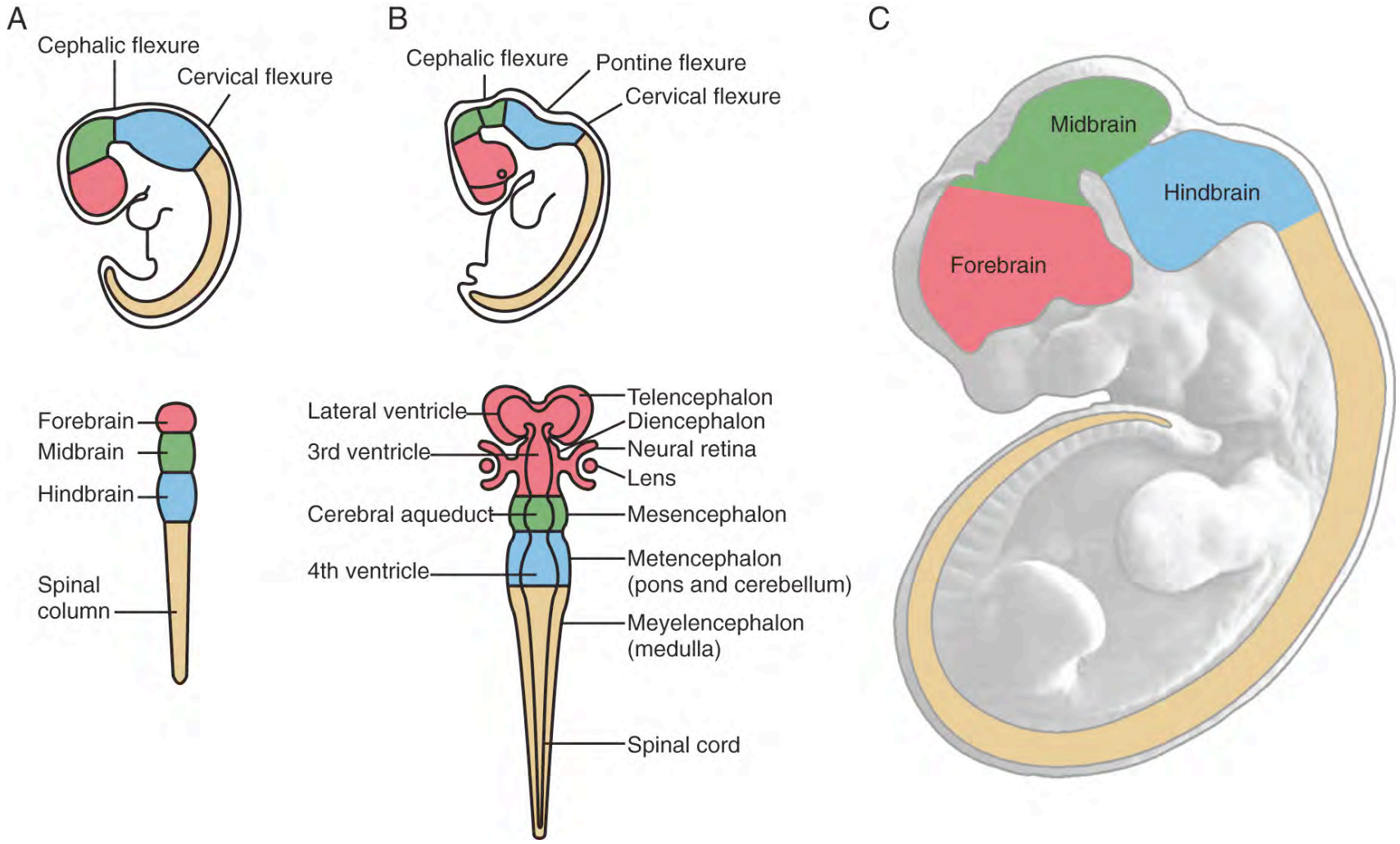
MCDB 153

"Molecular and Cellular Approaches to Neural Development

Lectures ~4-6

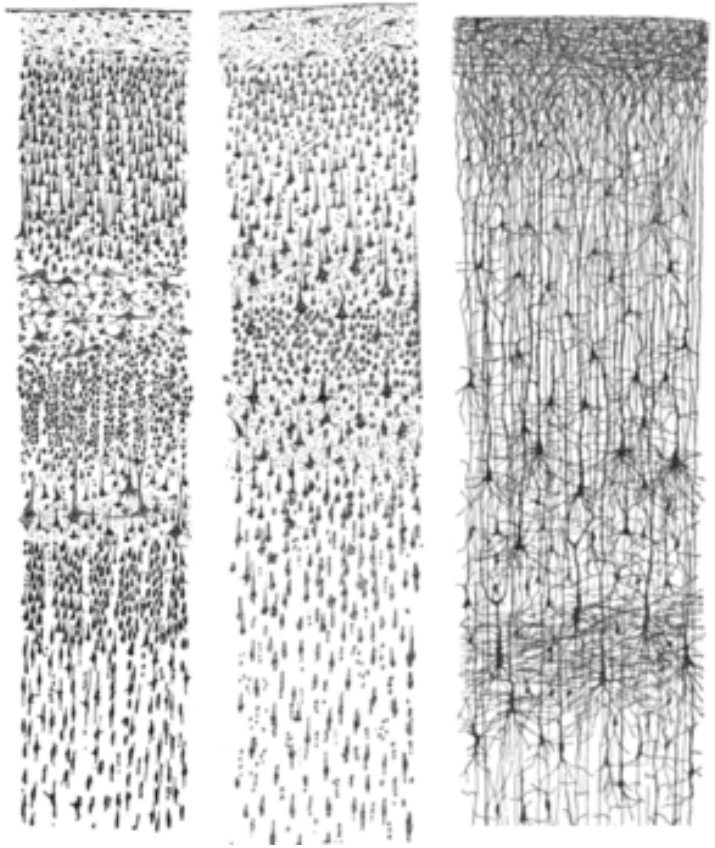
"Early Neural Development (part 2)"
Neurogenesis, Migration, Polarity and Differentiation
Lecture Set 3

Proliferation and Differentiation of the Nervous System



Neuroblast Proliferation occurs in the Neural Tube…..
…….but how do the "cortical layers" form?

(drawing by Ramon y Cajal)



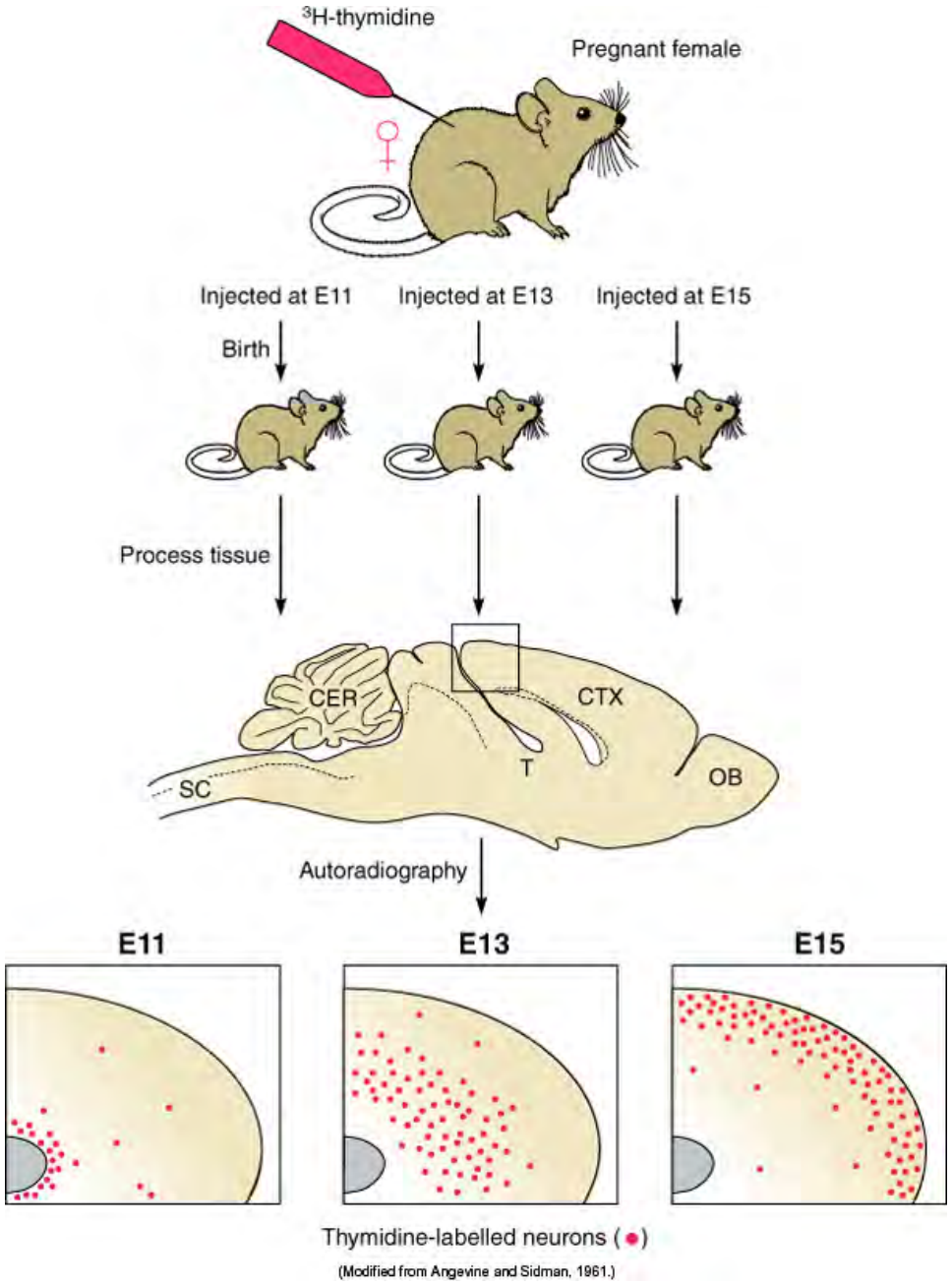
Neuroblast Proliferation occurs in the Neural Tube…..

Where in the tube is cell division occurring?

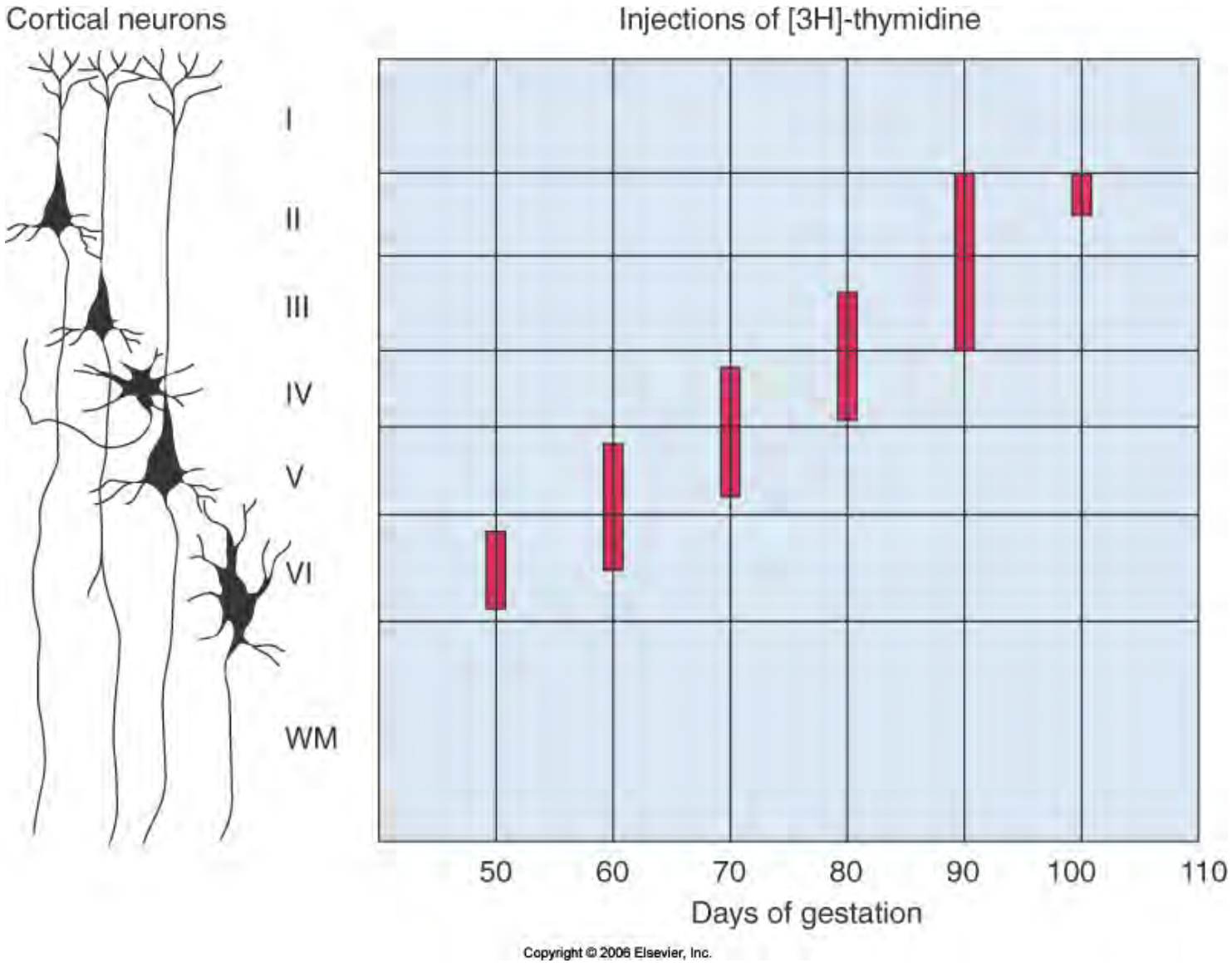
^{3}H thymidine "pulse" and "pulse-chase" labelling experiments

Birth-dating studies reveal the "inside-out organization of cerebral cortex

(Label at E11,13,15; then assay as adults)



Inside out organization of monkey cerebral cortex



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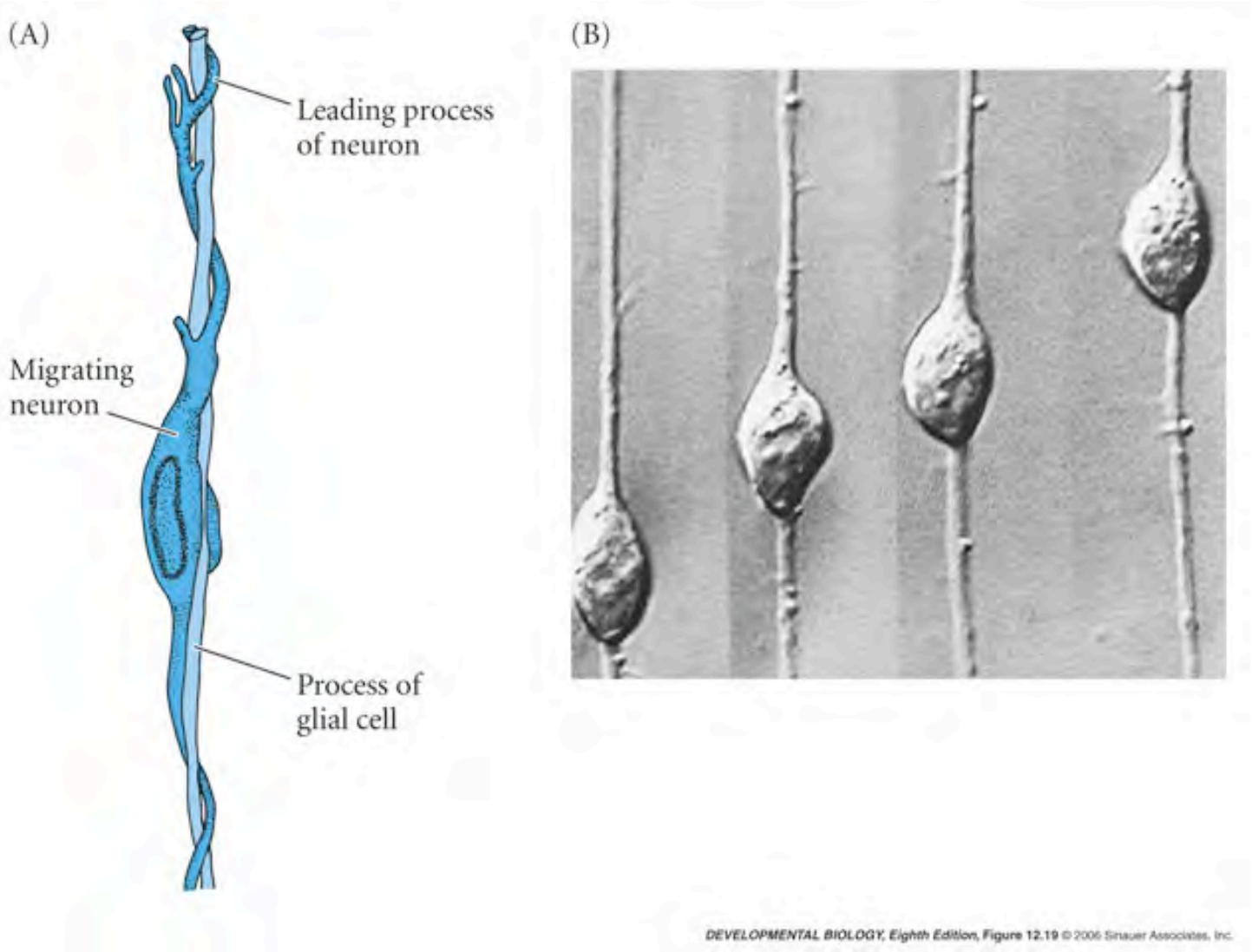
Migration of neurons along radial glia



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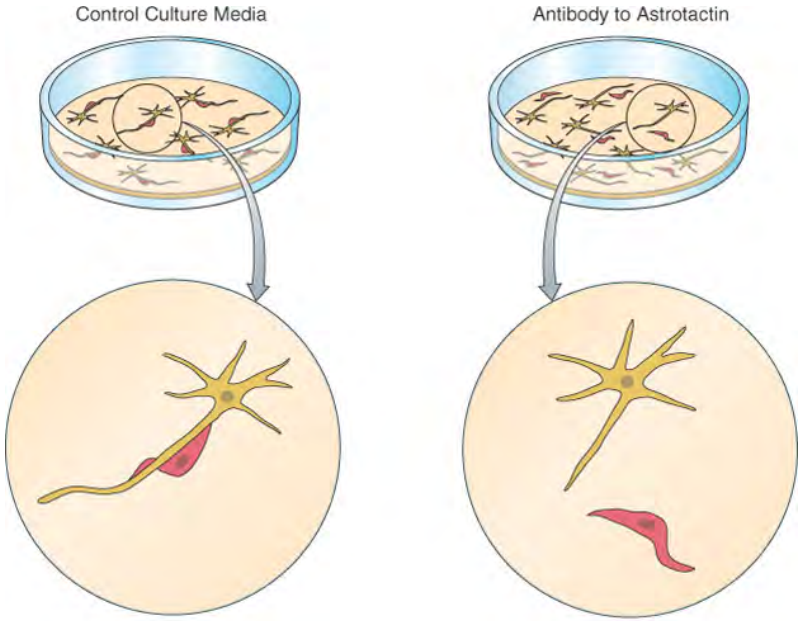
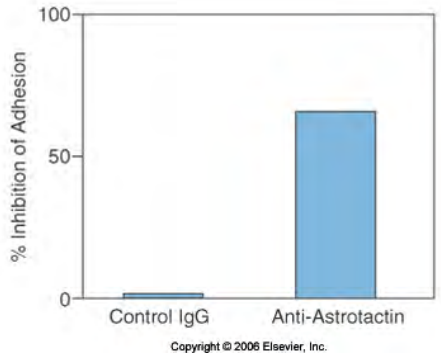
Migration of neurons along radial glia





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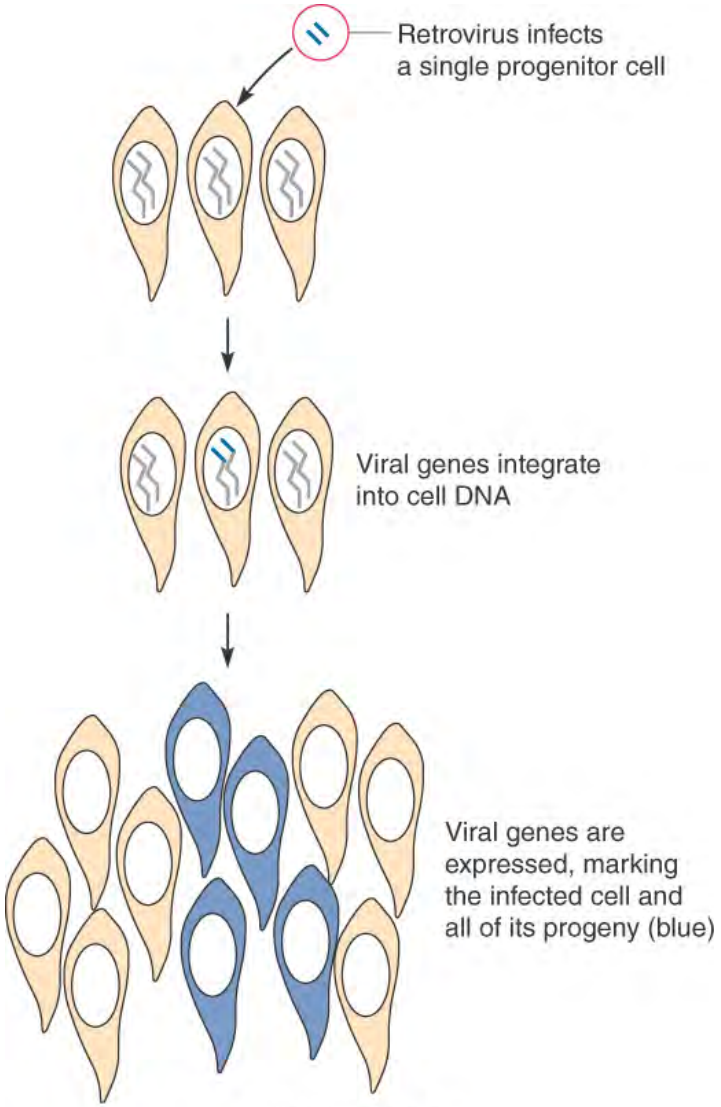
Astrotactin is necessary for migration along glia



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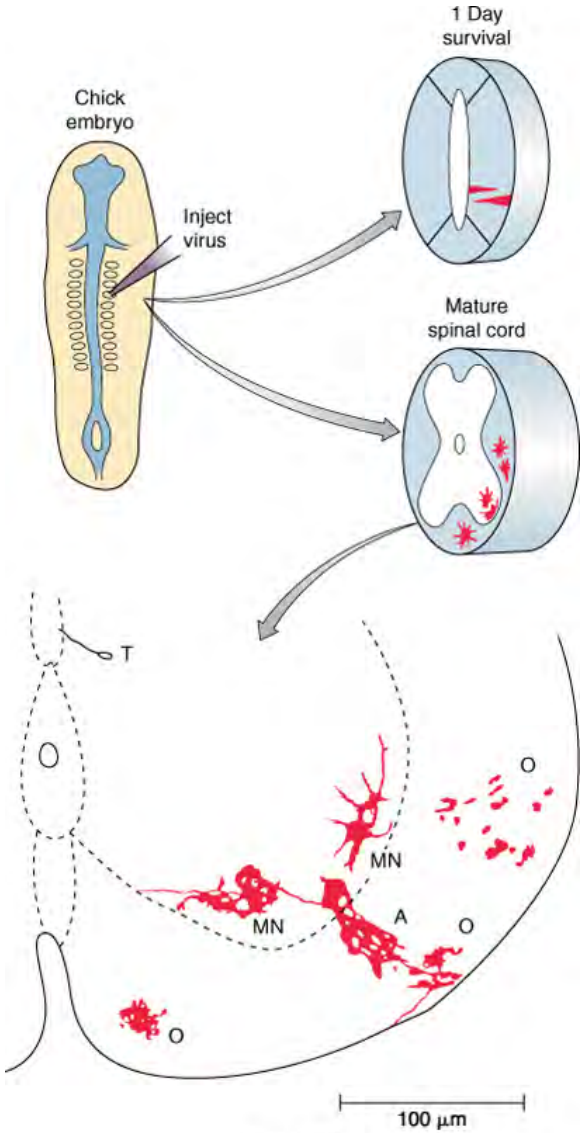


(Leber et al., 1990).

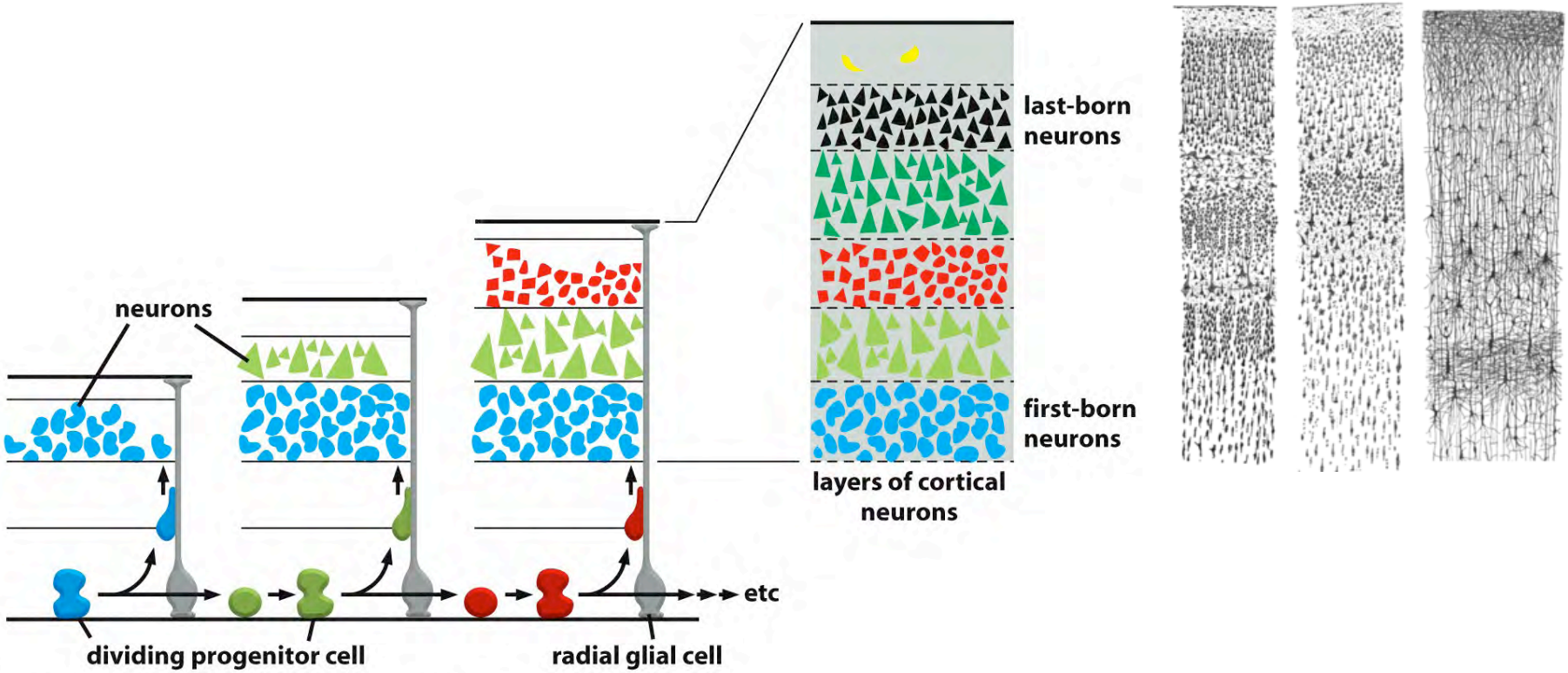
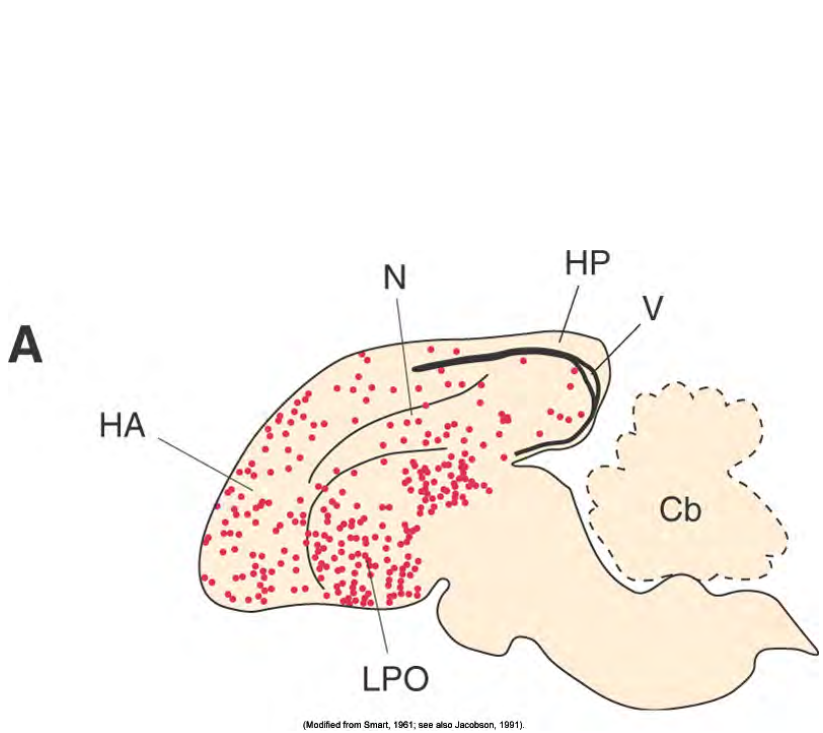
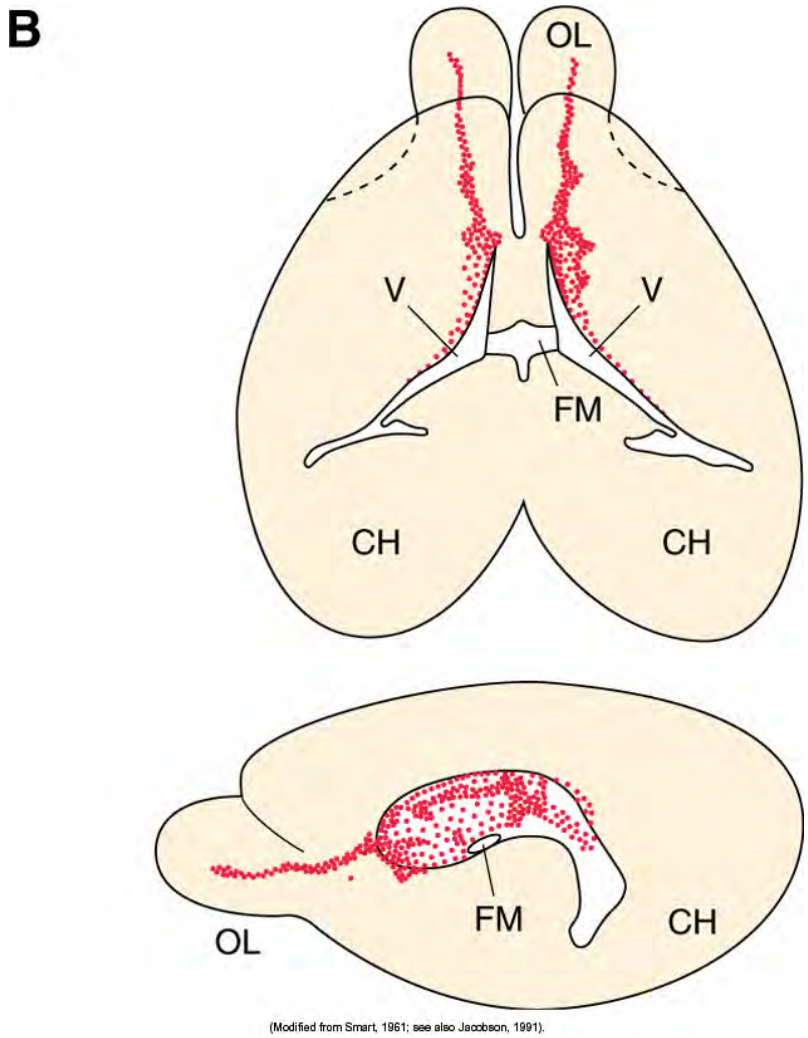


Figure 22-99 Molecular Biology of the Cell 5/e (© Garland Science 2008)

Adult Neurogenesis in Canary and Rodents

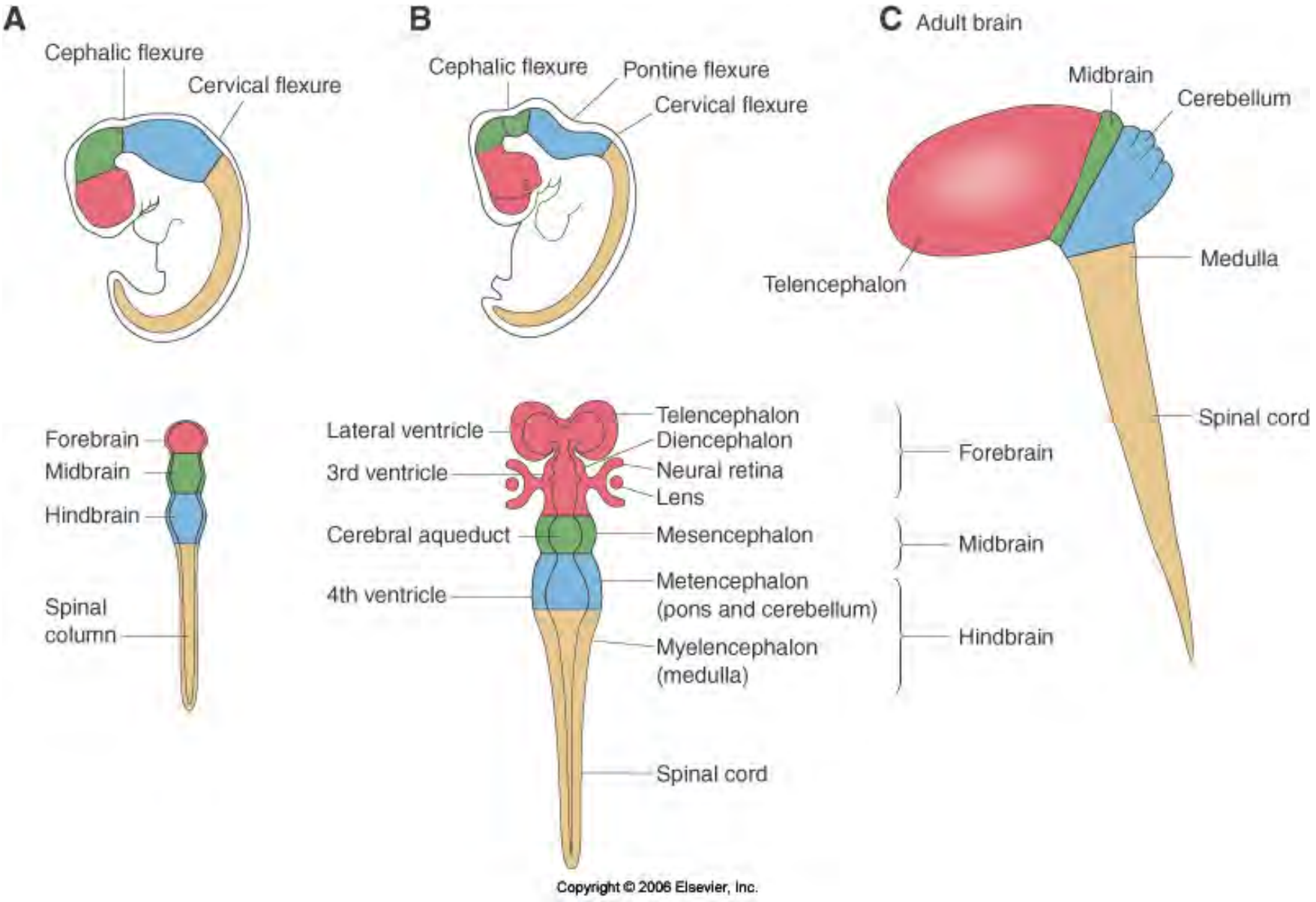




How do we get different cell types?
(i.e., polarity and differentiation)

Intrinsic and/or Extrinsic Influences?

Proliferation and Differentiation of the Nervous System



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The environment can influence the fate of neural crest cells

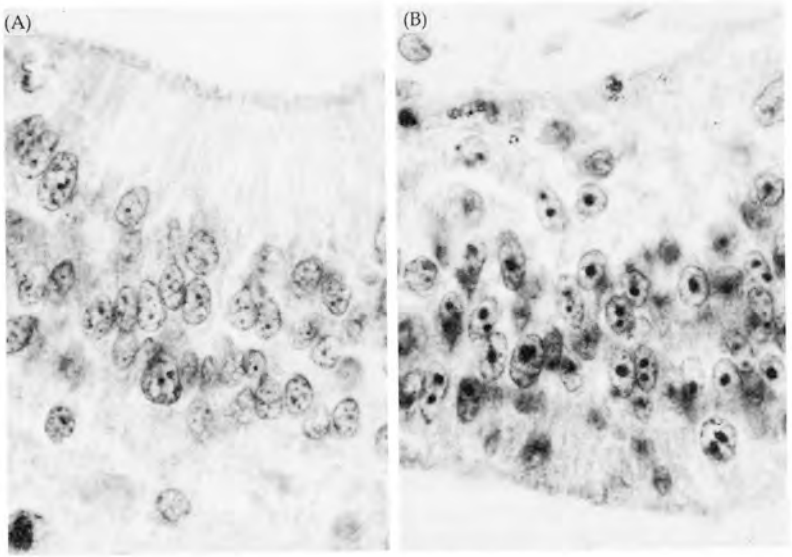
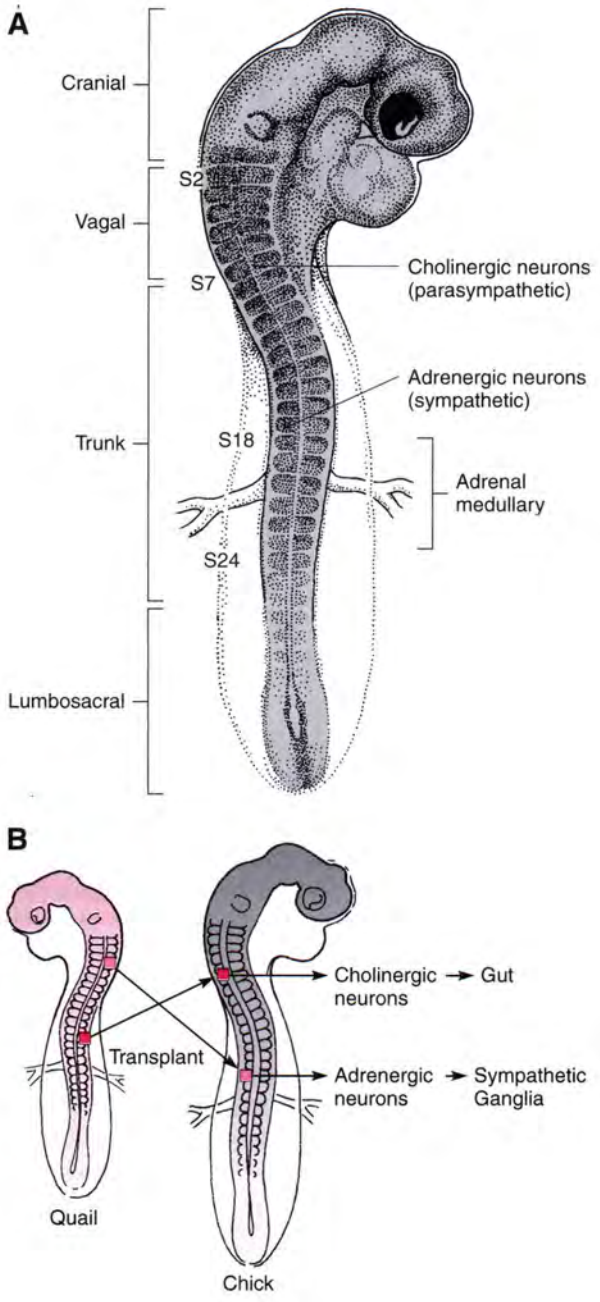
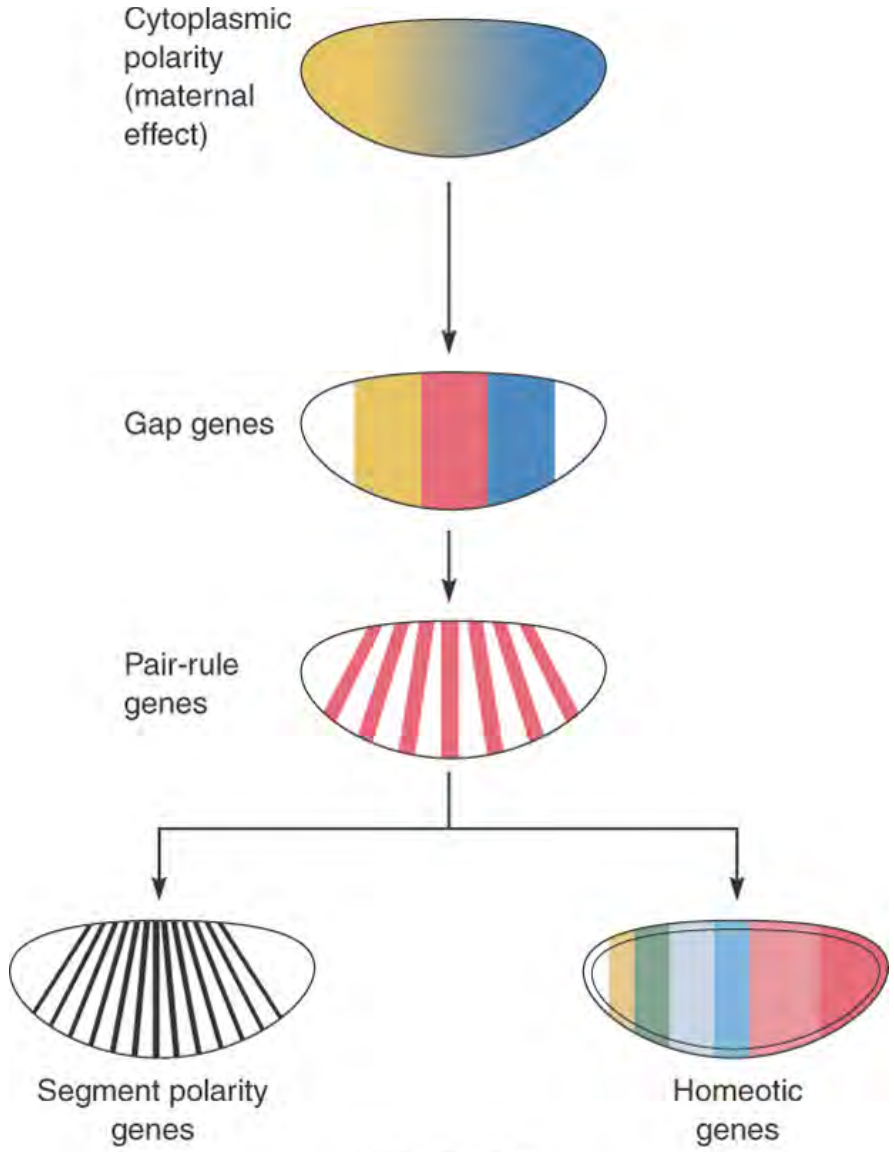


FIGURE 9. *Morphological differences between chick and quail cells can be used to asssess the fate of interspecies neural crest transplants. Chick cells (A) have less prominent nucleoli than quail cells (B) when stained by the Feulgen technique. These photomicrographs were made from the mesencephalon of 7-day-old embryos. ×720. (Courtesy of N. LeDouarin.)*



Determining position in a fly



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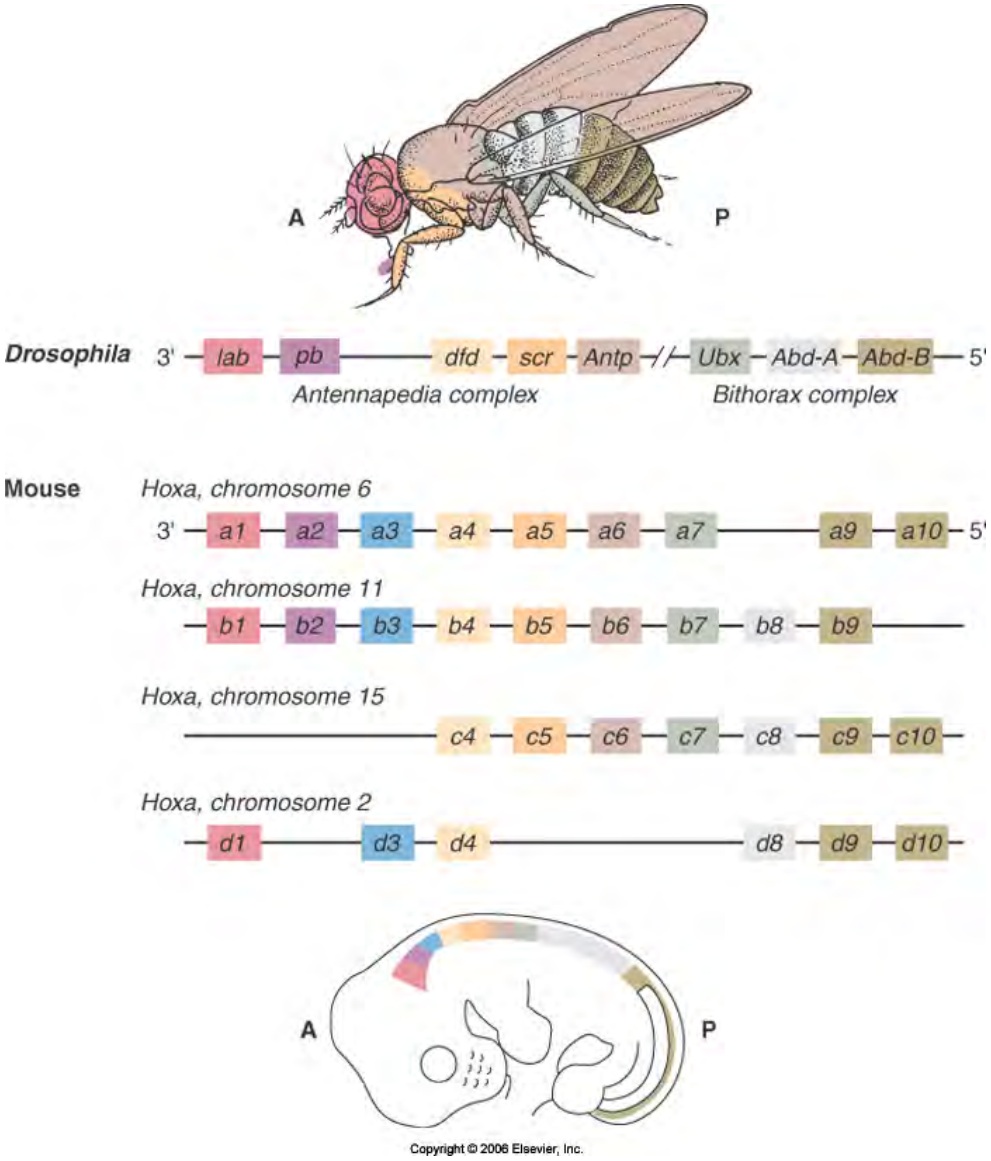
Hox genes are spatially organized in animals and chromosomes



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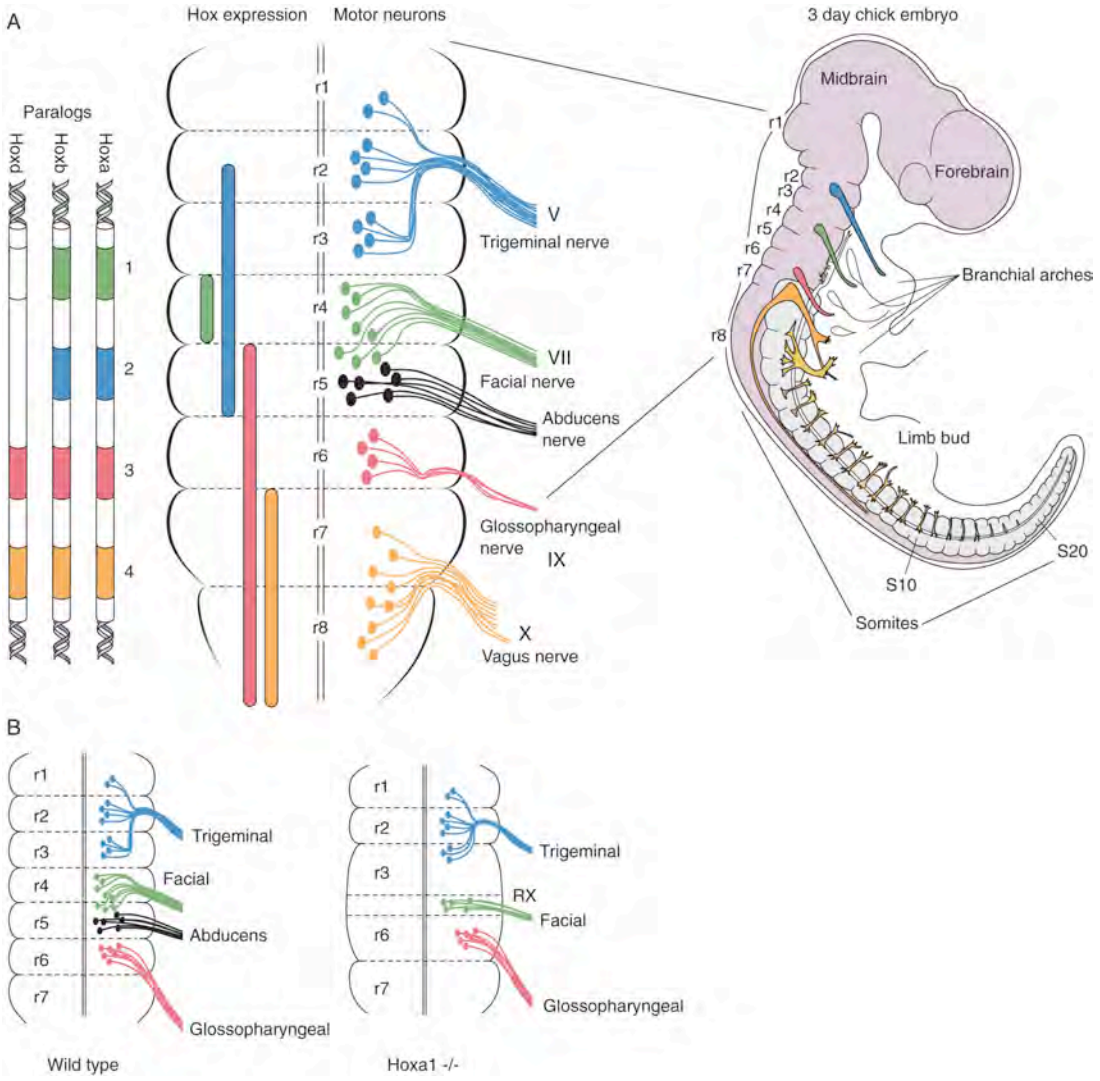
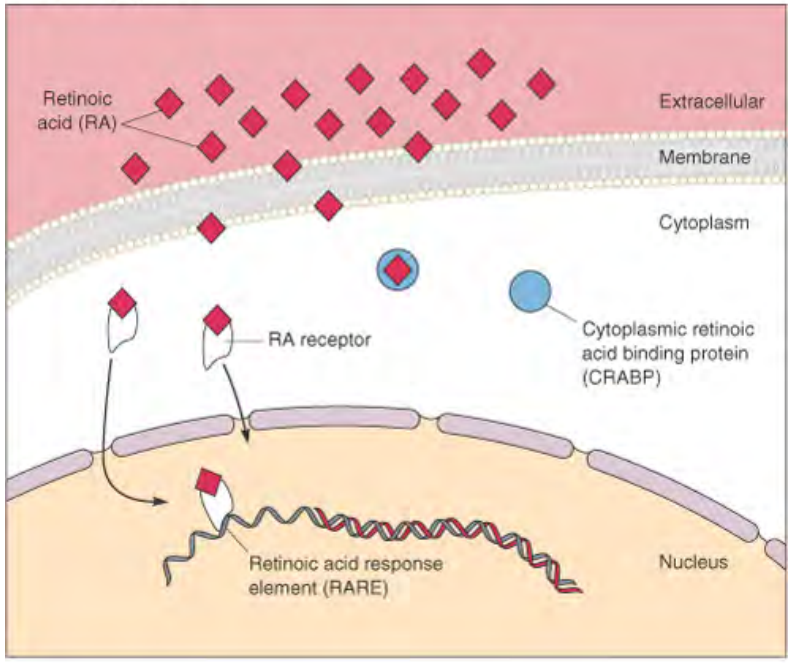
Hox genes and vertebrate hindbrain development

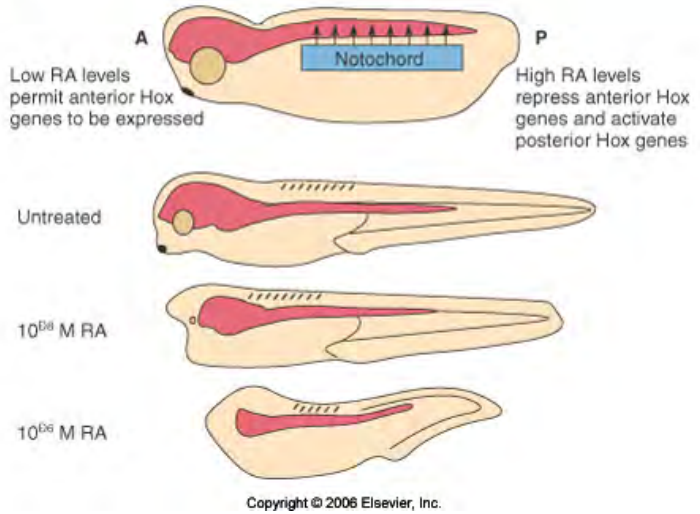


Anterior-Posterior Polarity of the Nervous System:Retinoic Acid

RA signalling system



RA in posterior mesoderm at neurula stage



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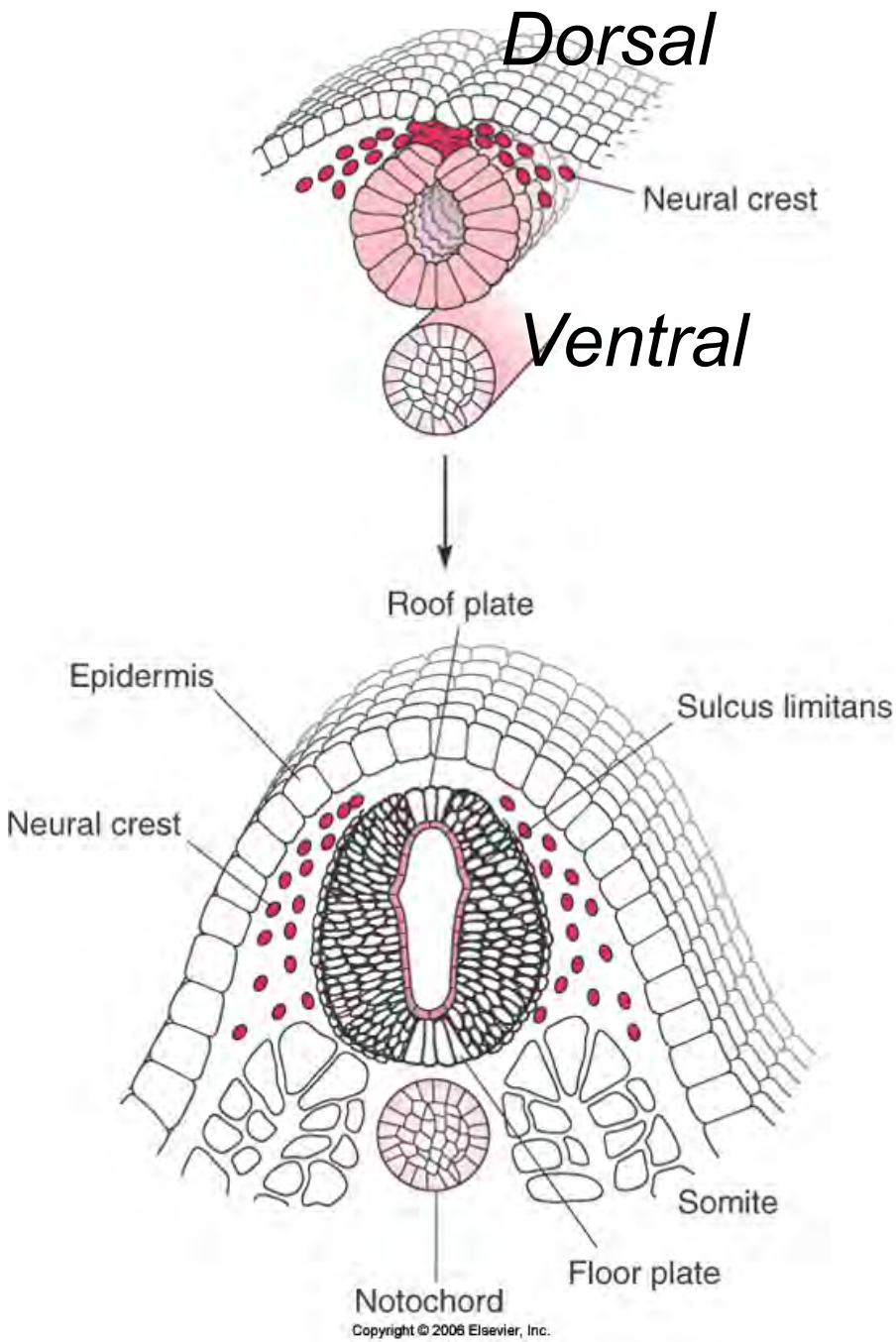
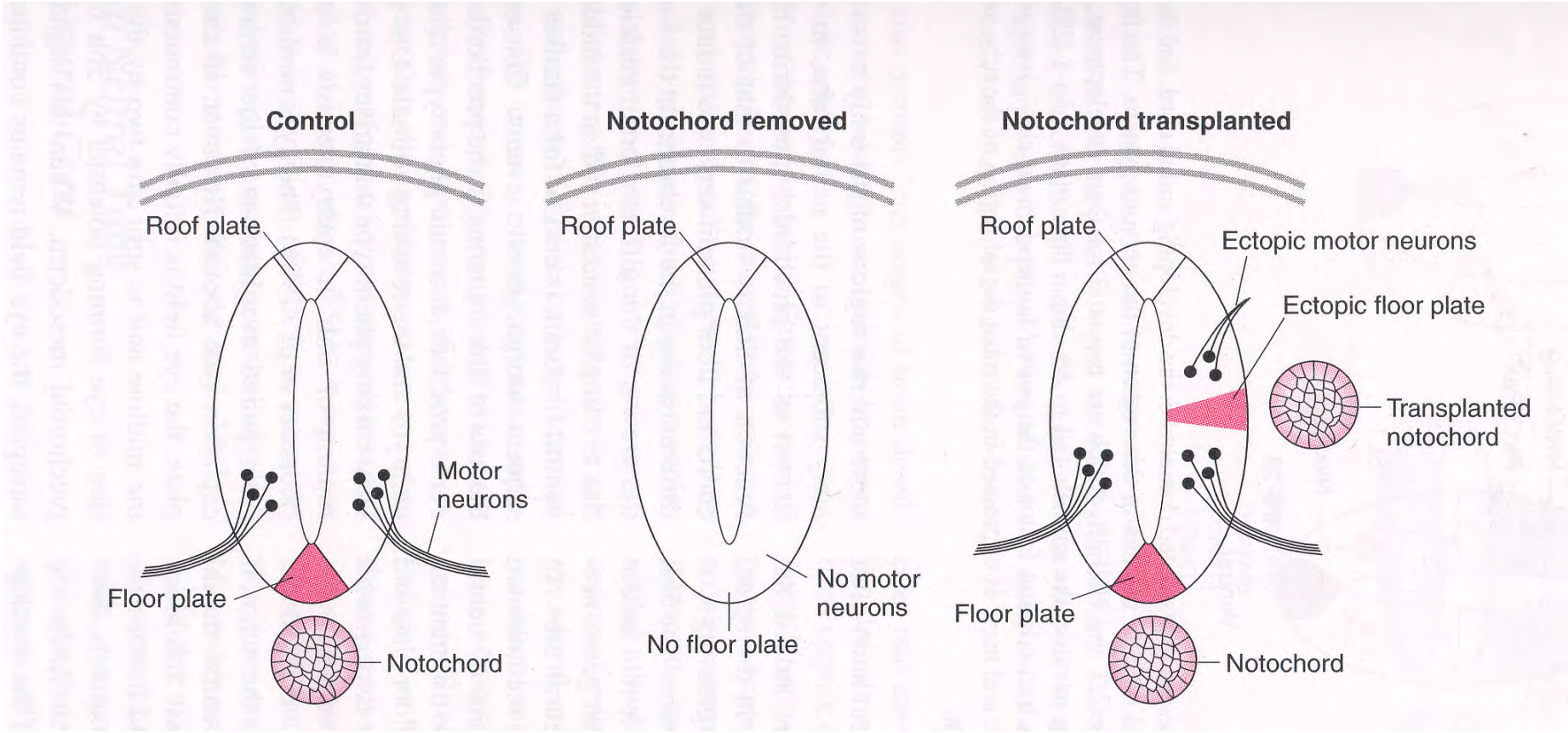
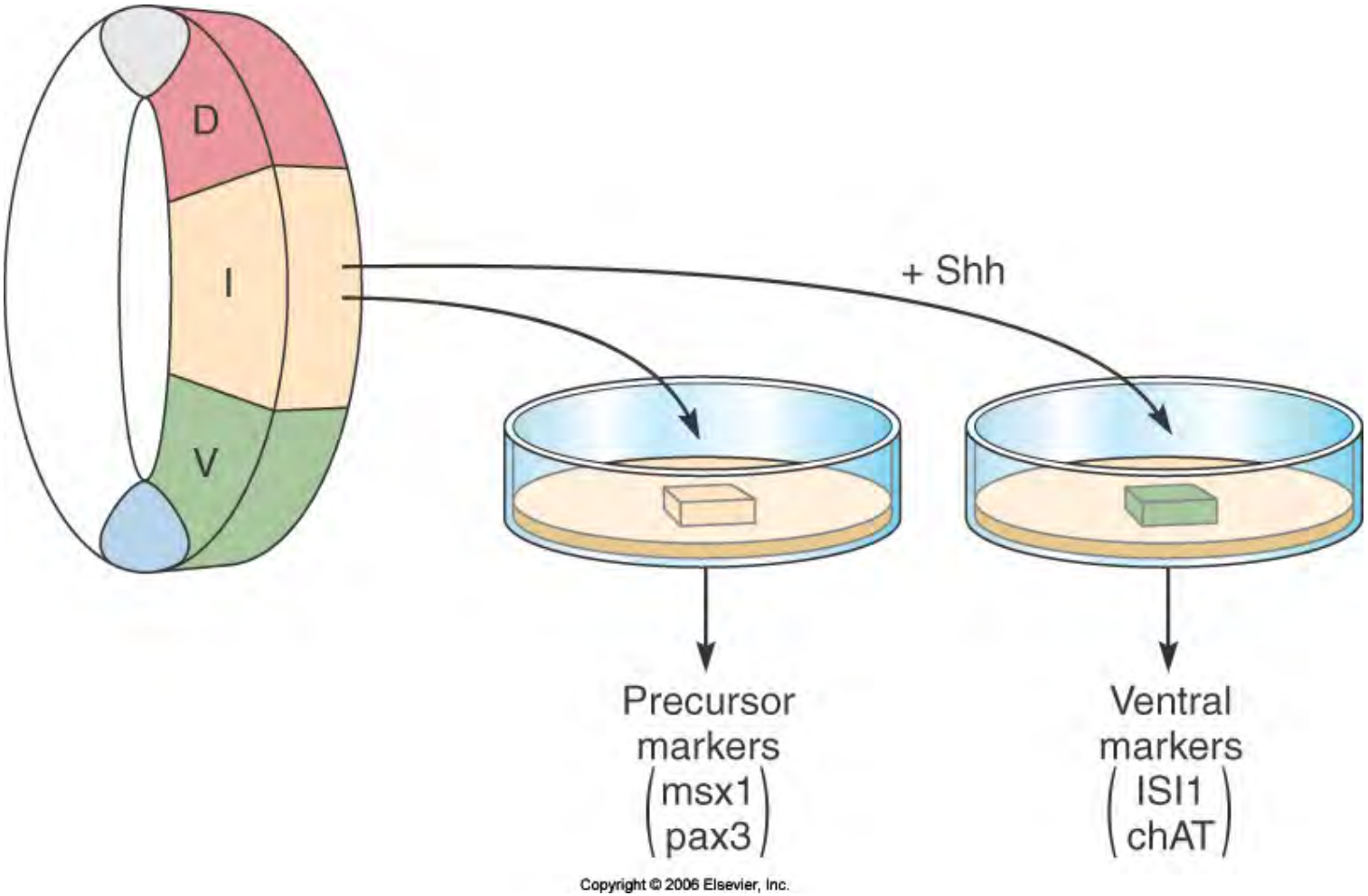
Dorsal-Ventral organization of the neural tube



Influence of the notocord on dorsal-ventral polarity of neural tube cell fate



Cell culture system used to identify Shh as a mesodermal factor inducing ventralization of the neural tube



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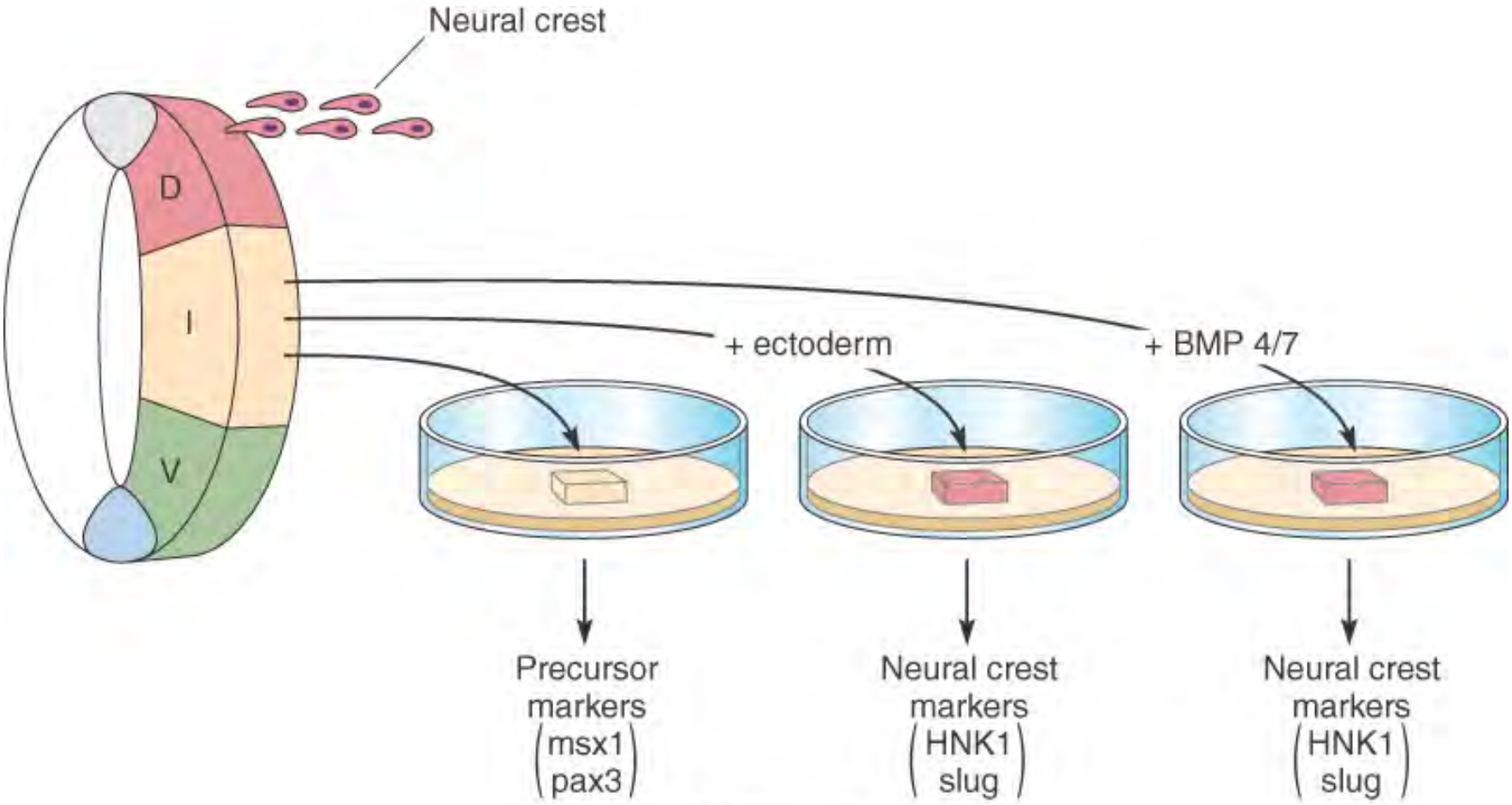
Cell culture system used to examine BMP as a dorsalizing factor for the neural tube



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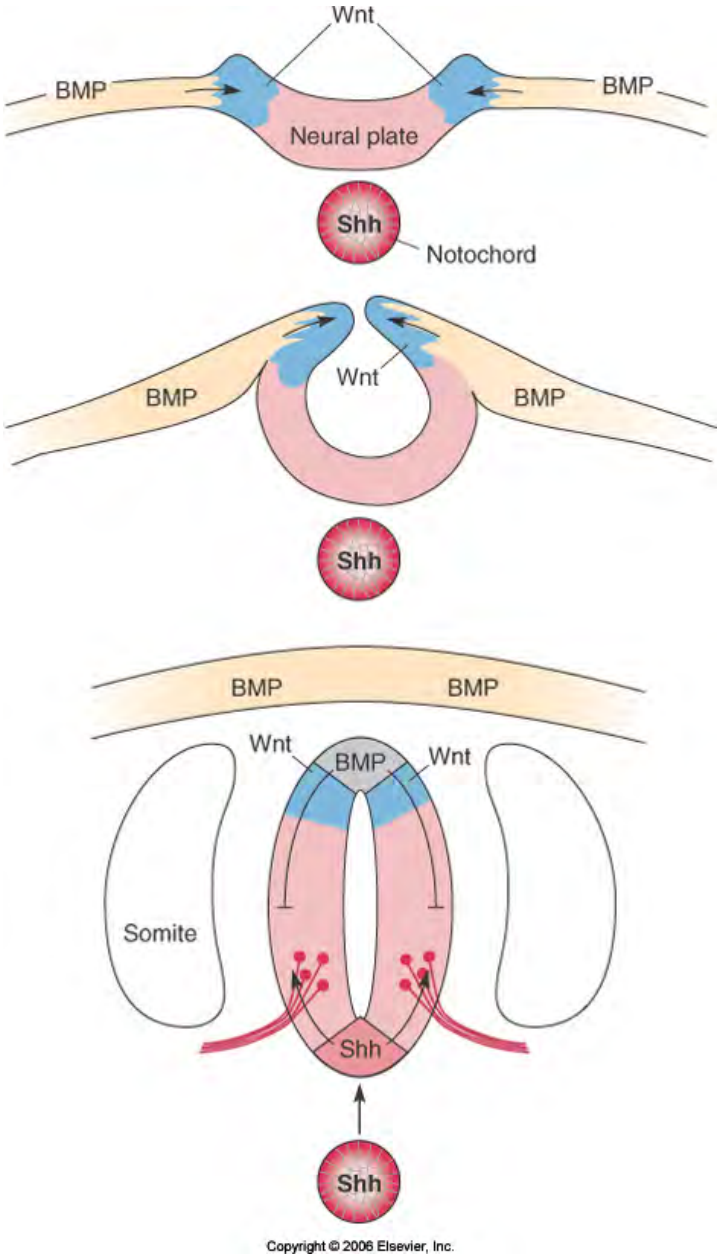
Current model for how dorsal-ventral axis is specified in the developing neural tube



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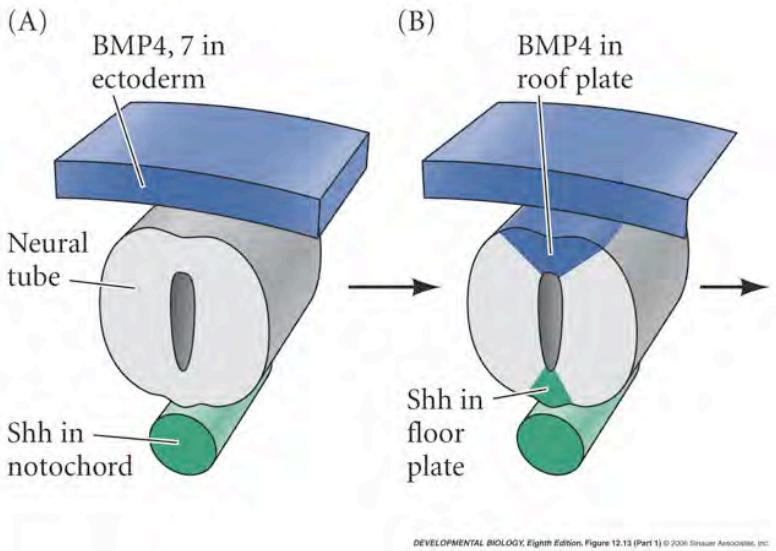

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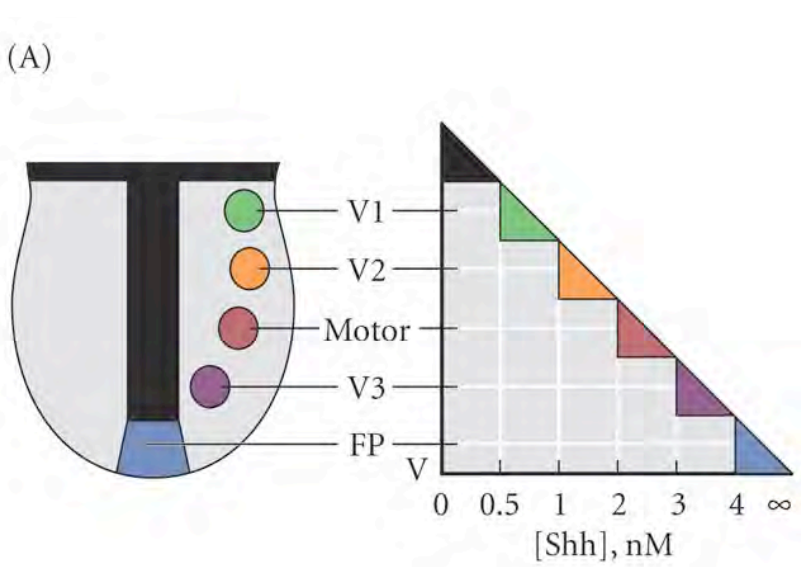

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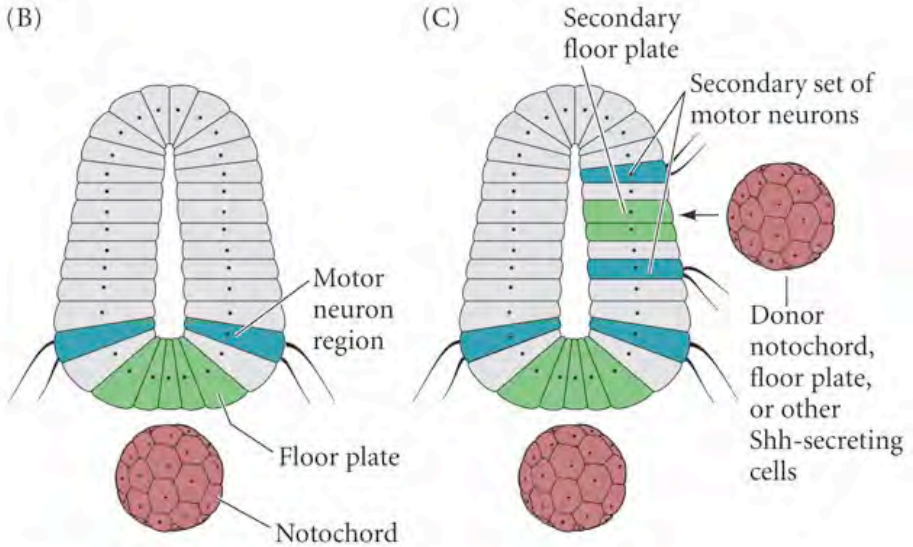

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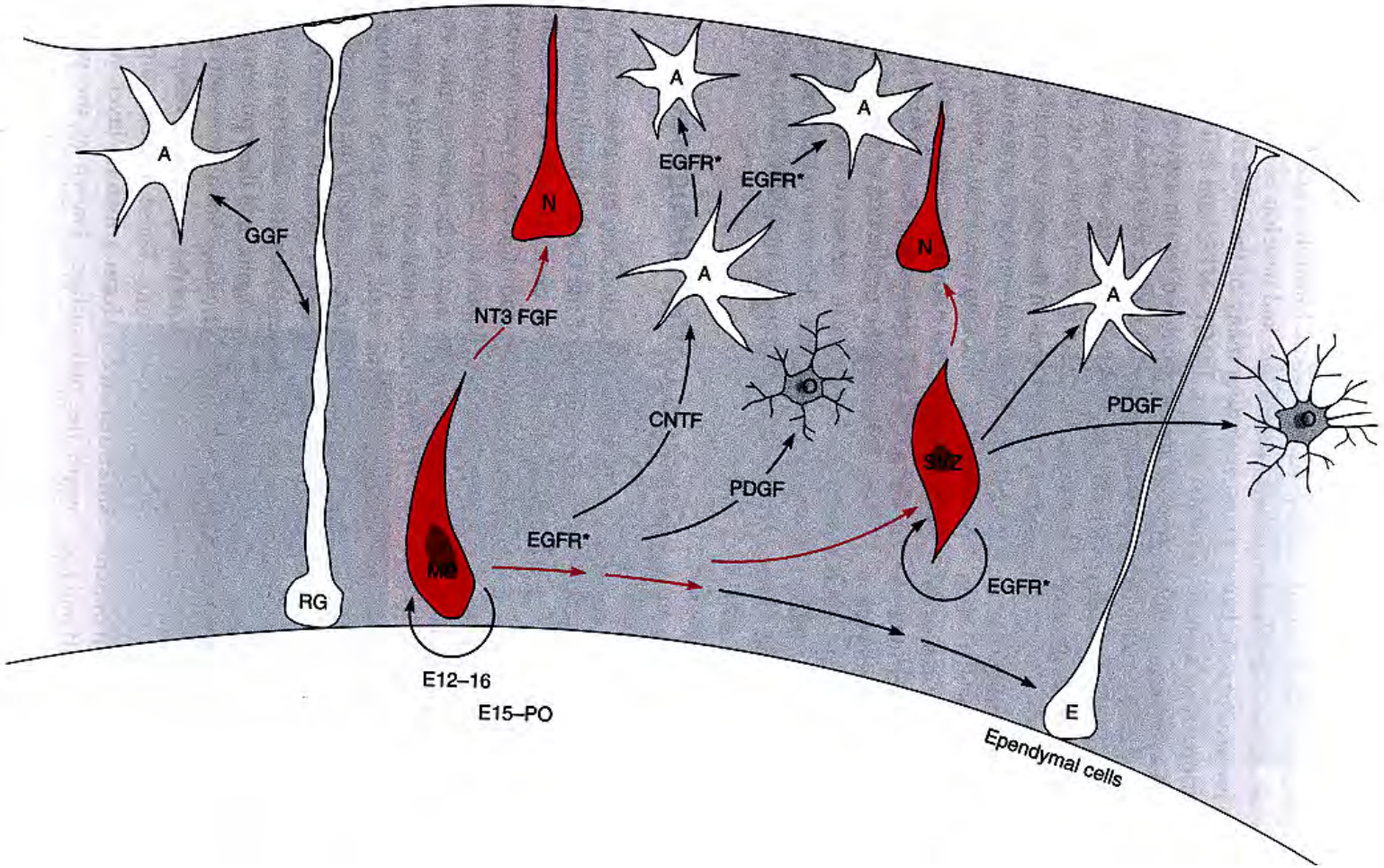
Growth factors present in different regions of the CNS can influence cell fate determination



Red: neural Grey: oligodendrocyte
White: astrocyte

Growth factors present in different regions of the CNS can influence cell fate determination