

For real amazement, if you wish to be amazed, is this process. You start out with a single cell derived from the coupling of a sperm and an egg; this divides in two, then four, then eight, and so on, and at a certain stage there emerges a single cell which has as all its progeny the human brain. The mere existence of such a cell should be one of the great astonishments of the earth. People ought to be walking around all day, all through their waking hours calling to each other in endless wonderment, talking of nothing except that cell.

Lewis Thomas, 1979

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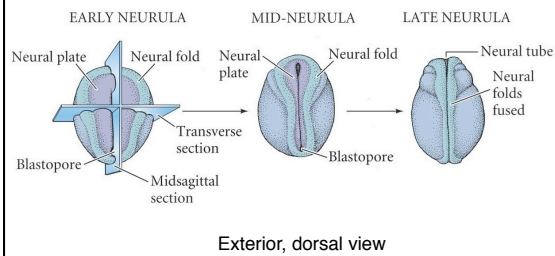
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Figure 12.4(1) Three Views of Neurulation in an Amphibian Embryo



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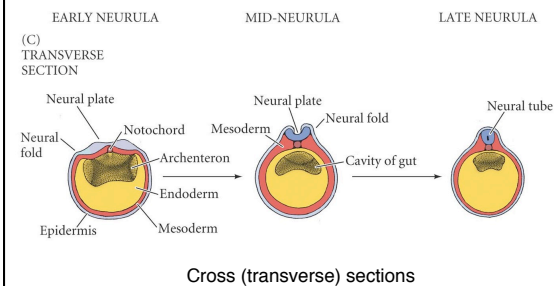
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Figure 12.4(2) Three Views of Neurulation in an Amphibian Embryo



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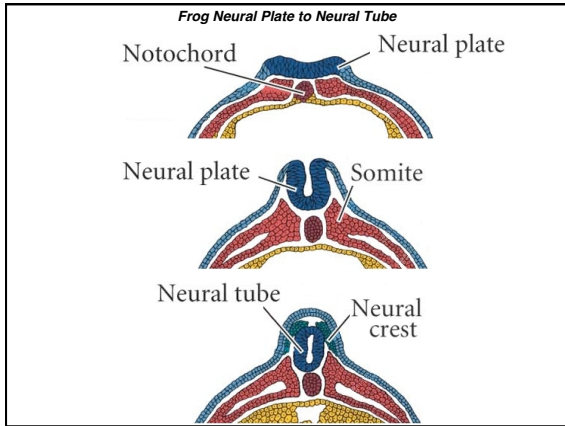
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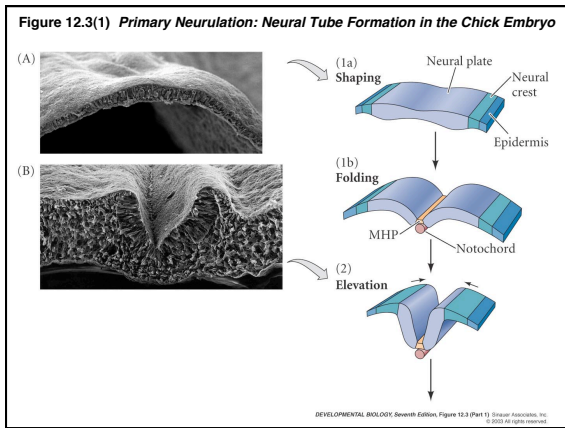
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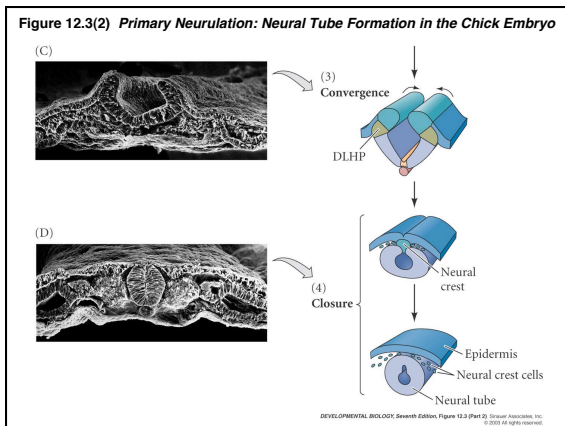
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**Spina Bifida in newborn - meningomyocele**

Warning: next slide - human birth defect

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**Spina Bifida in newborn - meningomyocele**



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**Neural Tube Defects: Spina Bifida and Anencephaly**

NTDs caused by genetic and environmental factors

Incidence

1970's: ~1 in 1000 live births (0.13%)

Recent: ~1 in 2000 (0.06%)

[Folic acid fortification of foods begins in 1998.]

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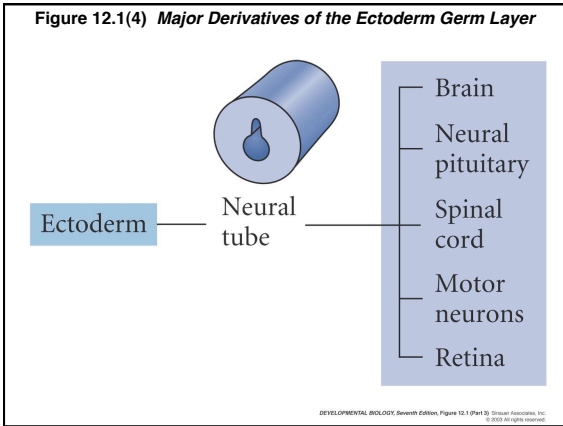
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**Figure 12.1(4) Major Derivatives of the Ectoderm Germ Layer**




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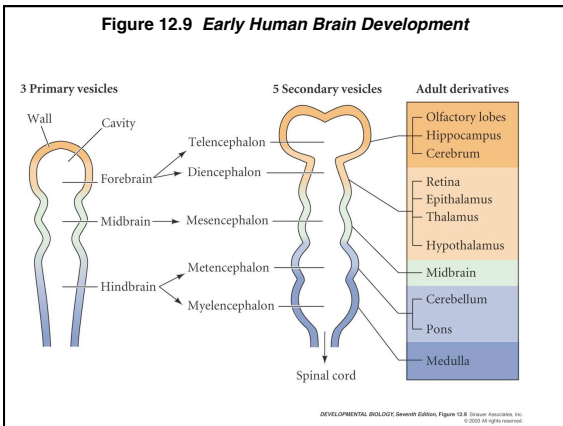
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**Figure 12.9 Early Human Brain Development**




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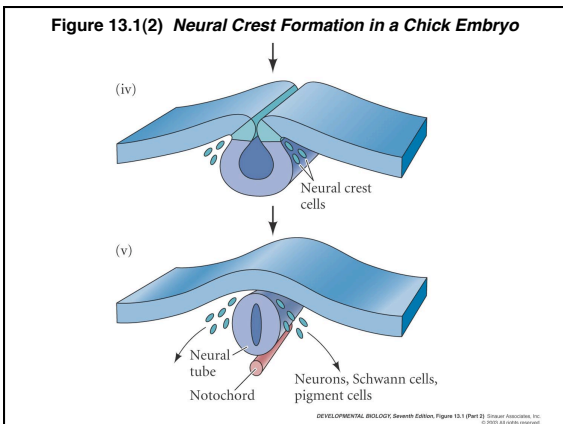
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**Figure 13.1(2) Neural Crest Formation in a Chick Embryo**




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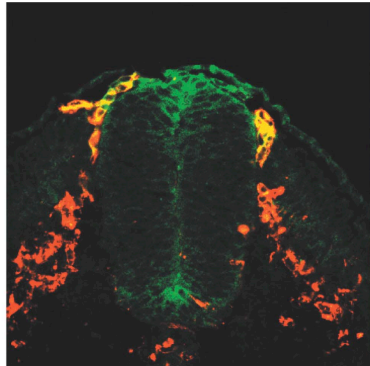
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Figure 13.4 Stained Migrating Neural Crest Cells



HNK-1 (red)

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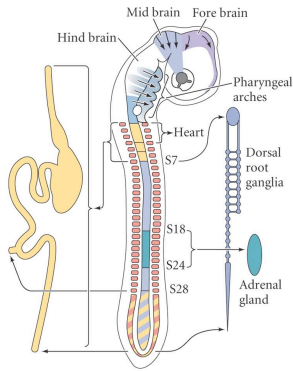
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Figure 13.2 Regions of the Neural Crest



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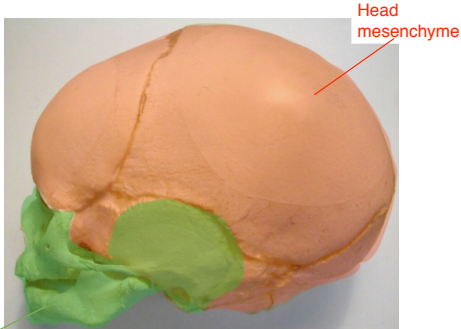
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Head mesenchyme & cranial neural crest derivatives in human fetal skull



Cranial neural crest

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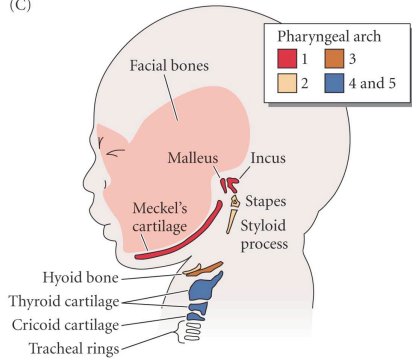
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**Fig. 13.8(3) Cranial Neural Crest Cell Migration in the Mammalian Head**

(C)




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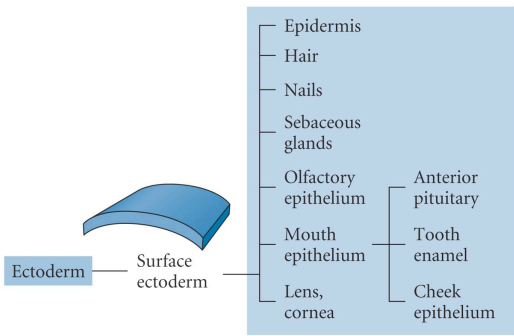


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**Figure 12.1(2) Major Derivatives of the Ectoderm Germ Layer**




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