

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

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

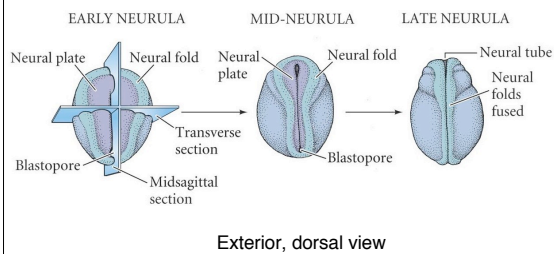


Figure 12.4(2) Three Views of Neurulation in an Amphibian Embryo

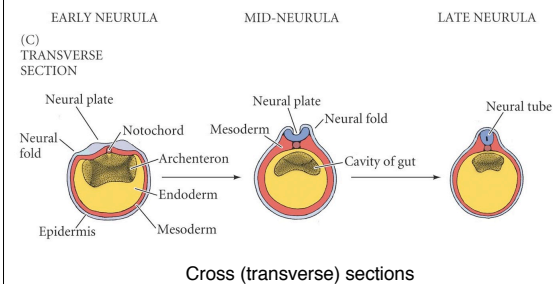


Figure 12.3(1) Primary Neurulation: Neural Tube Formation in the Chick Embryo

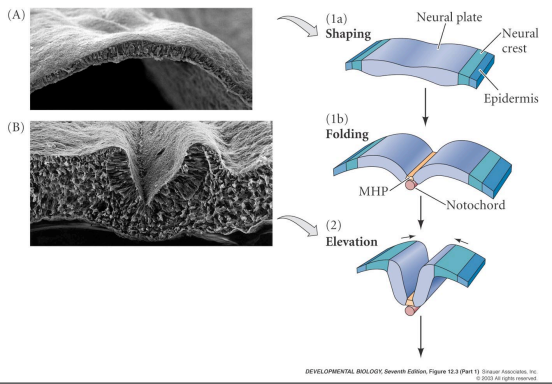


Figure 12.3(2) Primary Neurulation: Neural Tube Formation in the Chick Embryo

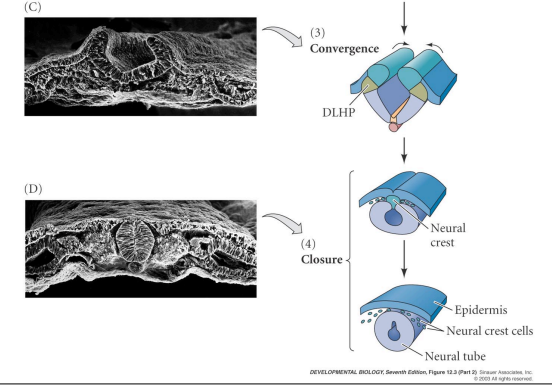
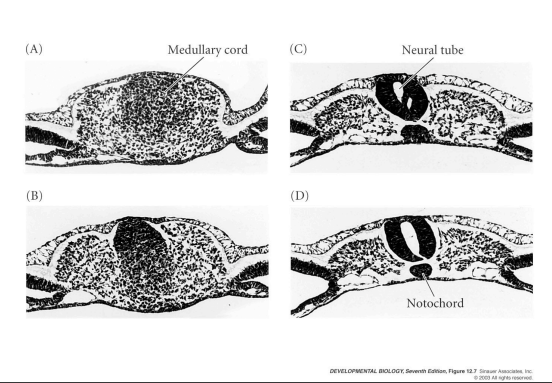
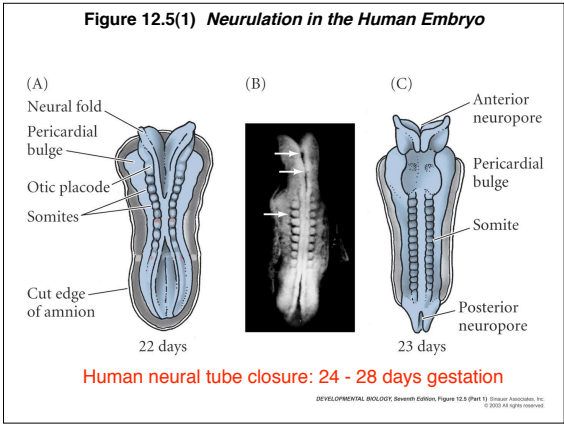
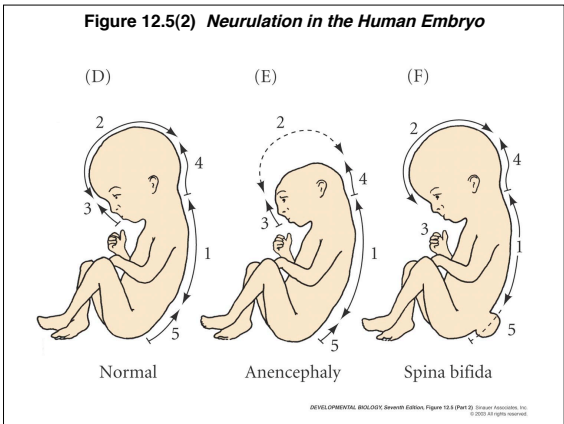


Figure 12.7 Secondary Neurulation in the Caudal Region of the Chick Embryo







Spina Bifida in newborn - meningocele

Warning: next slide - human birth defect

Spina Bifida in newborn - meningoencephalocele



Neural Tube Defects: Spina Bifida and Anencephaly

NTDs caused by genetic and environmental factors

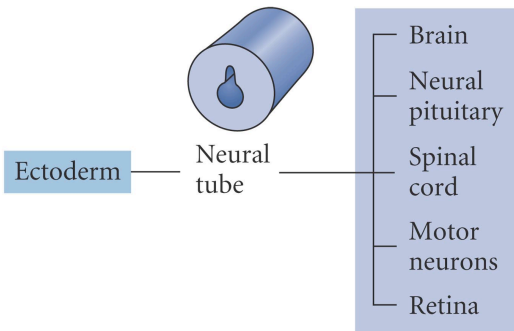
Incidence

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

Recent: ~1 in 2000 (0.06%)

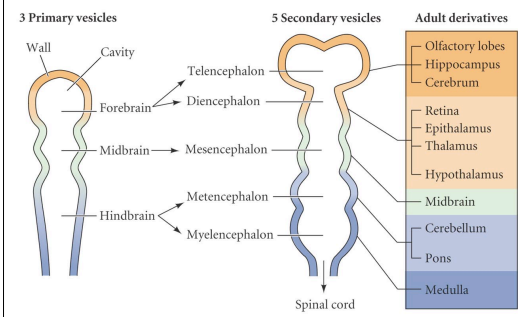
[Folic acid fortification of foods begins in 1996.]

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



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Figure 12.9 Early Human Brain Development



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The Human Brain

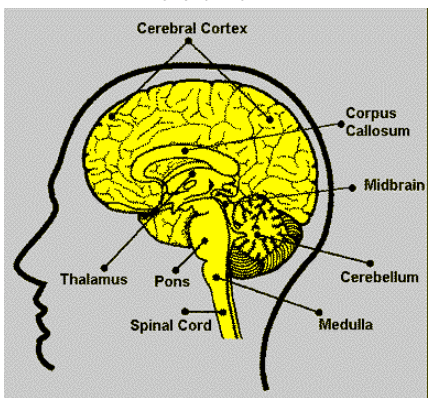
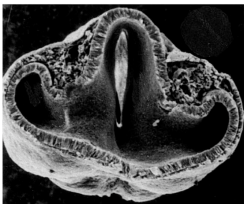
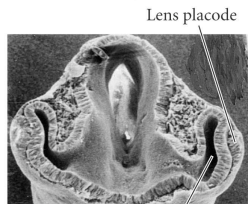


Figure 12.26(1) Development of the Vertebrate Eye

(A) 4-mm embryo

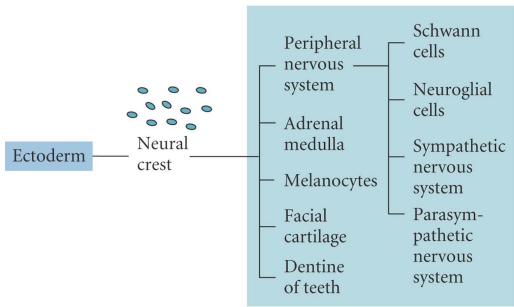


(B) 4.5-mm embryo



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Figure 12.1(3) Major Derivatives of the Ectoderm Germ Layer



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Table 13.1 Neural crest derivatives

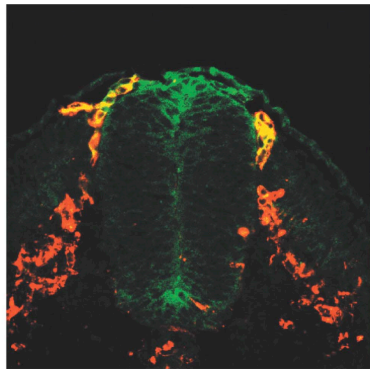
TABLE 13.1 Some derivatives of the neural crest

Derivative	Cell type or structure derived
Peripheral nervous system (PNS)	Neurons, including sensory ganglia, sympathetic and parasympathetic ganglia, and plexuses Neuroglial cells Schwann cells
Endocrine and paraendocrine derivatives	Adrenal medulla Calcitonin-secreting cells Carotid body type 1 cells
Pigment cells	Epidermal pigment cells
Facial cartilage and bone	Facial and anterior ventral skull cartilage and bones
Connective tissue	Corneal endothelium and stroma Tooth papillae Dermis, smooth muscle, and adipose tissue of skin of head and neck Connective tissue of salivary, lachrymal, thymus, thyroid, and pituitary glands Connective tissue and smooth muscle in arteries of aortic arch origin

Source: After Jacobson 1991, based on multiple sources.

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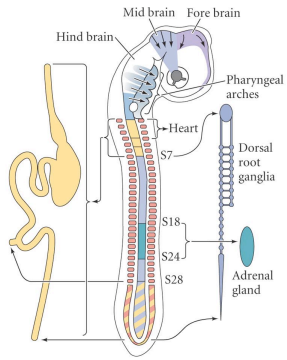
Figure 13.4 Stained Migrating Neural Crest Cells



HNK-1 (red)

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Figure 13.2 Regions of the Neural Crest



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Head mesenchyme & cranial neural crest derivatives in human fetal skull

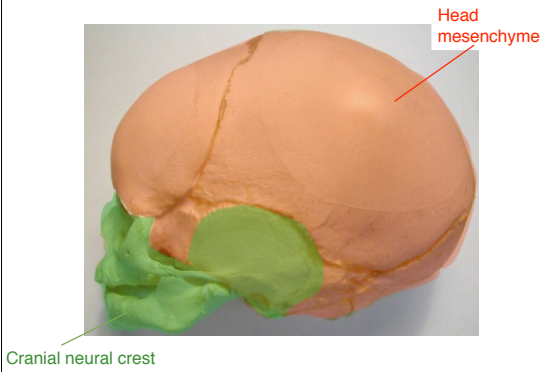
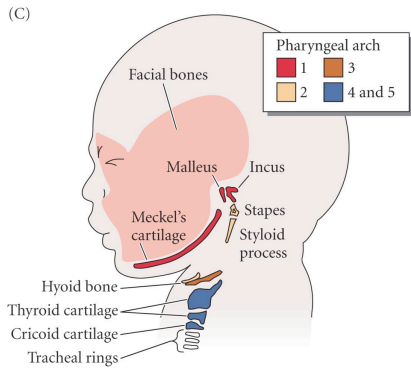


Fig. 13.8(3) Cranial Neural Crest Cell Migration in the Mammalian Head



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

