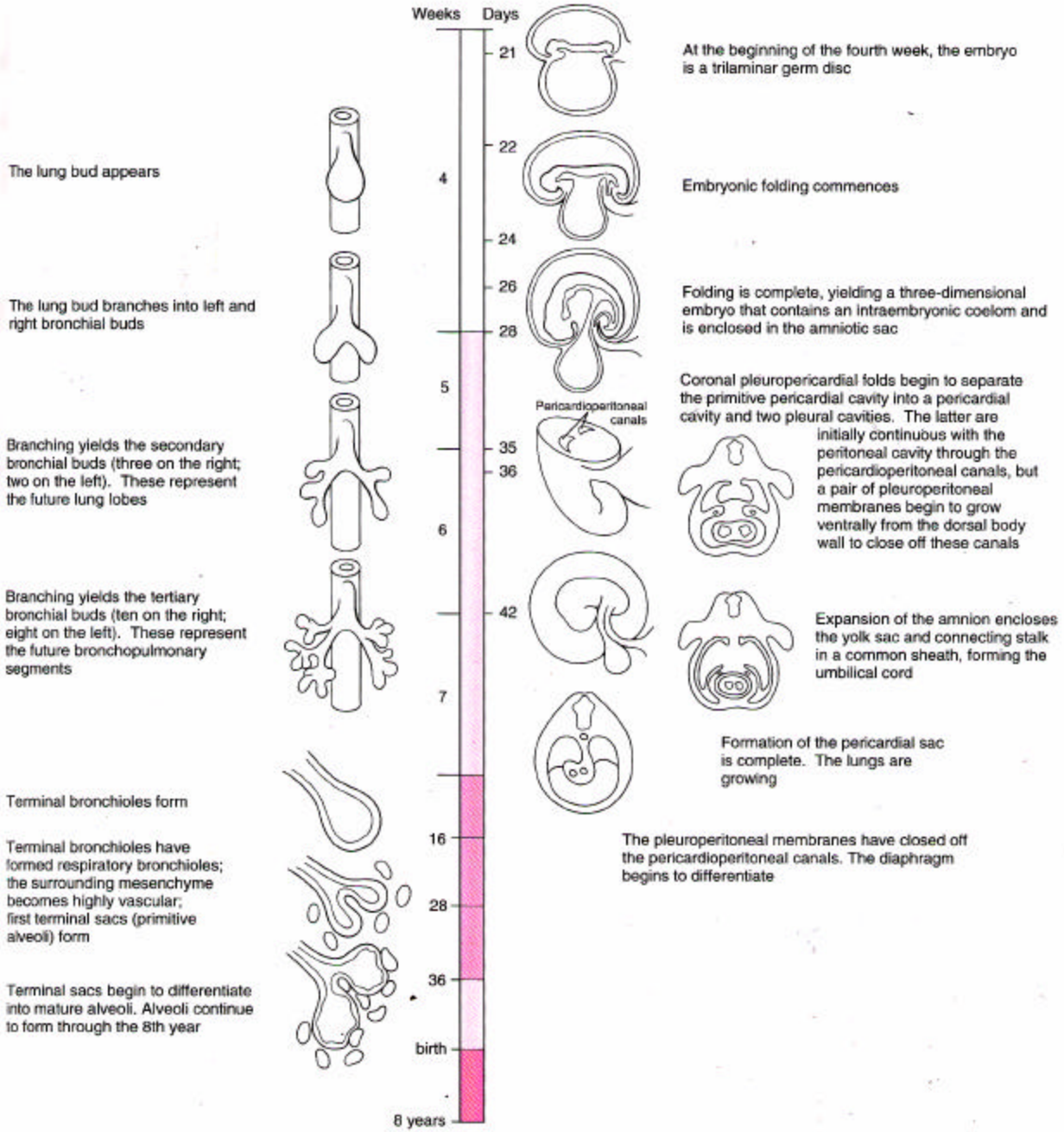
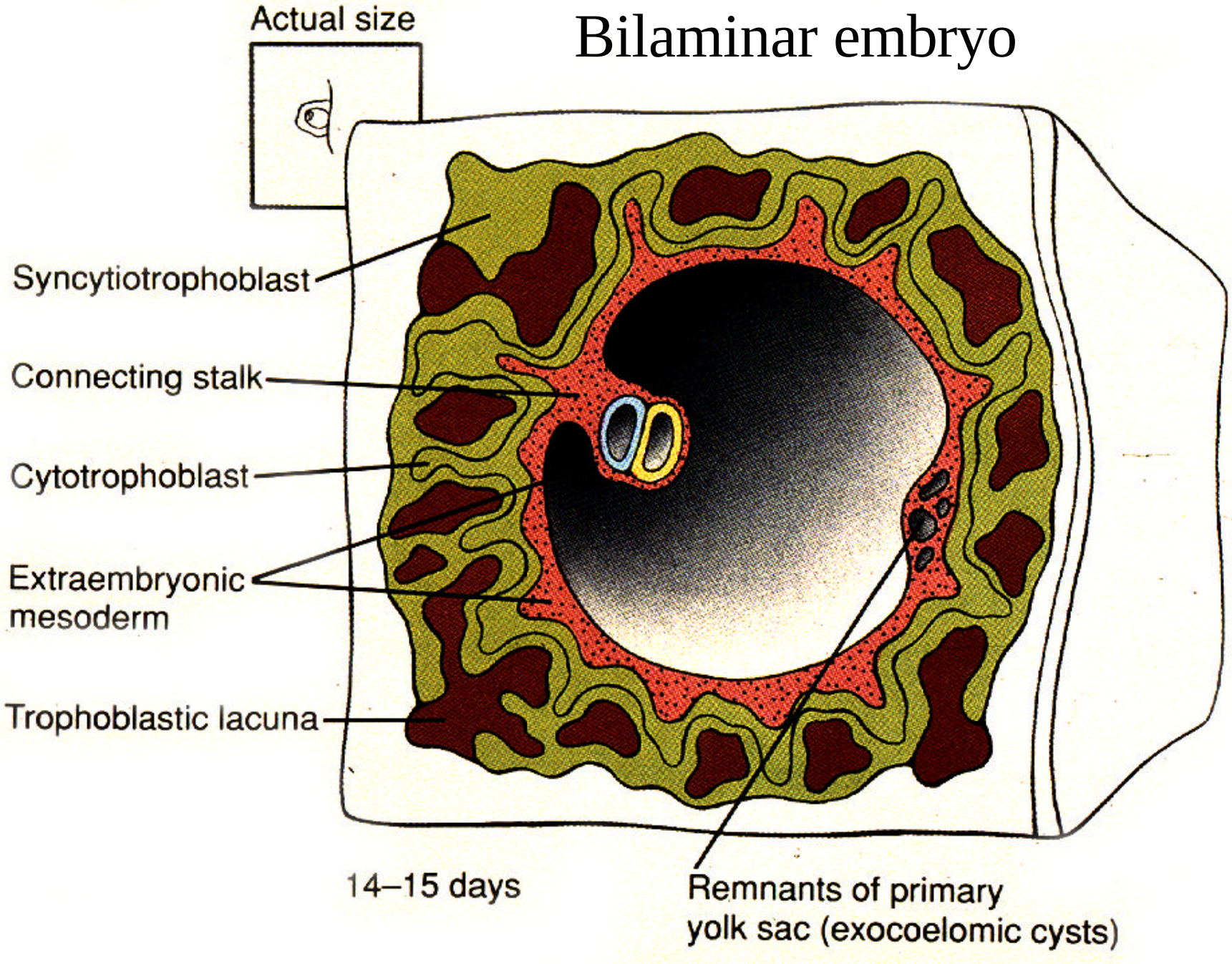
Embryonic Flexion and Folding

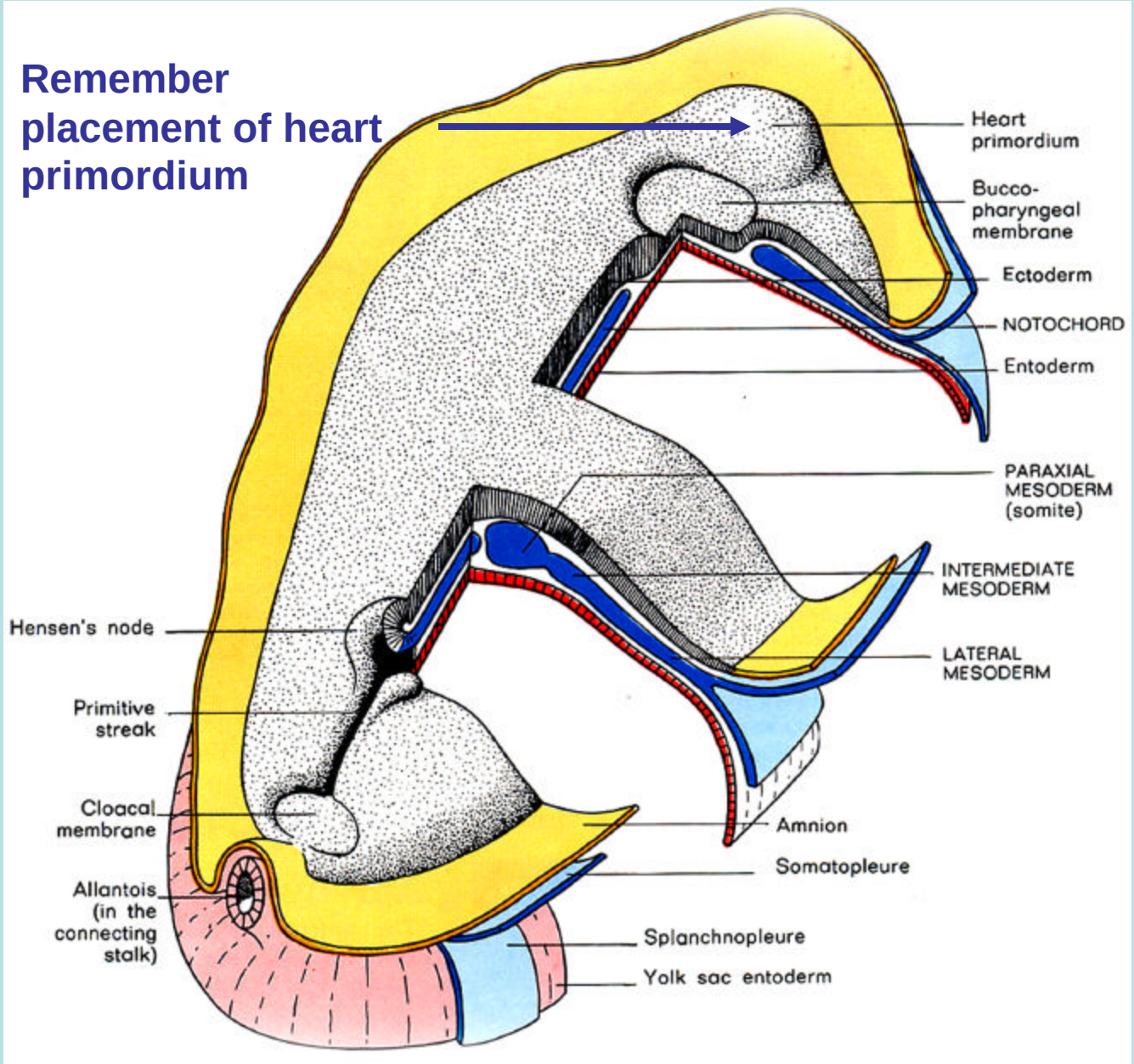


Timeline. Embryonic folding; development of the pericardial, pleural, and peritoneal cavities; and development of the lungs.

Bilaminar embryo



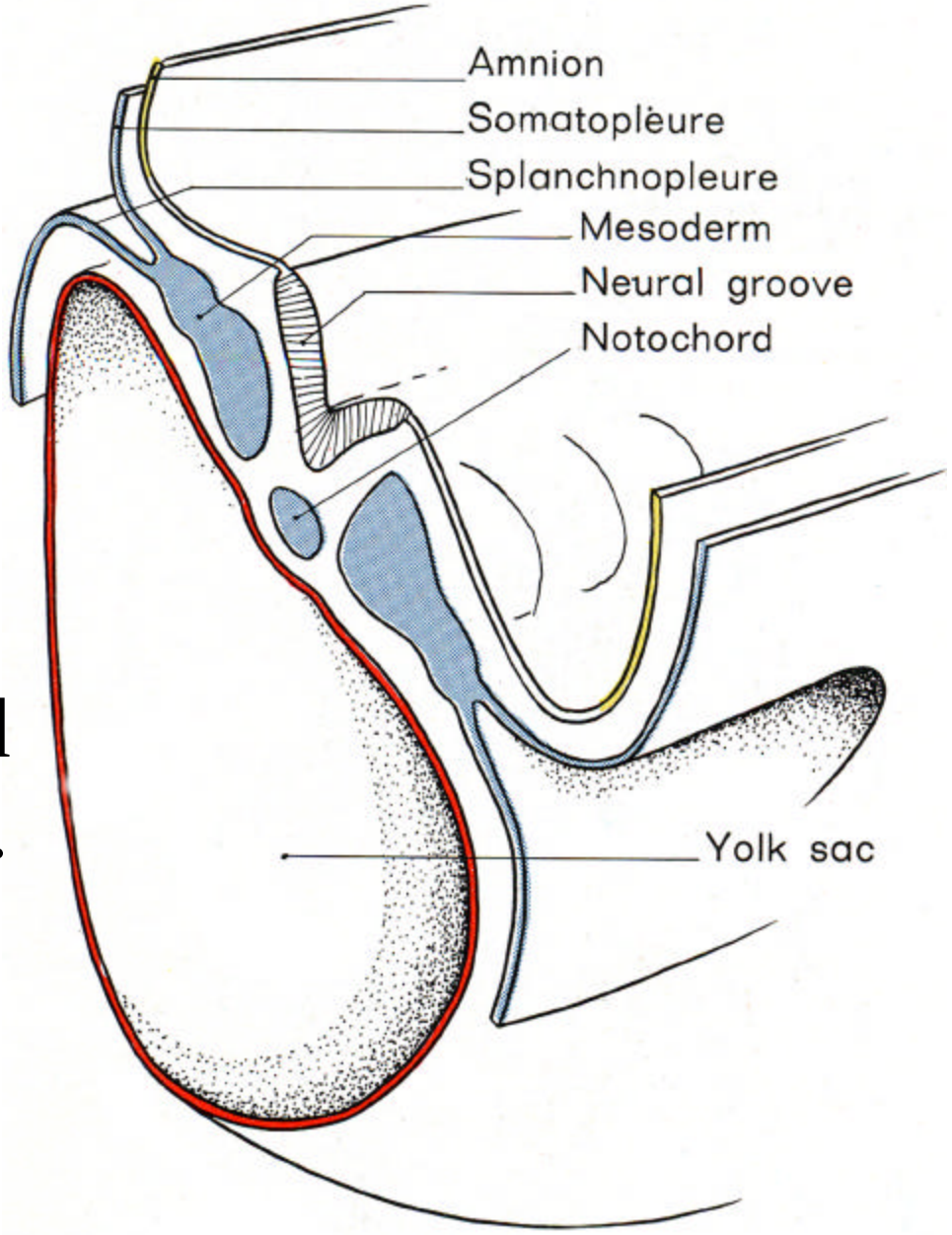
End of gastrulation



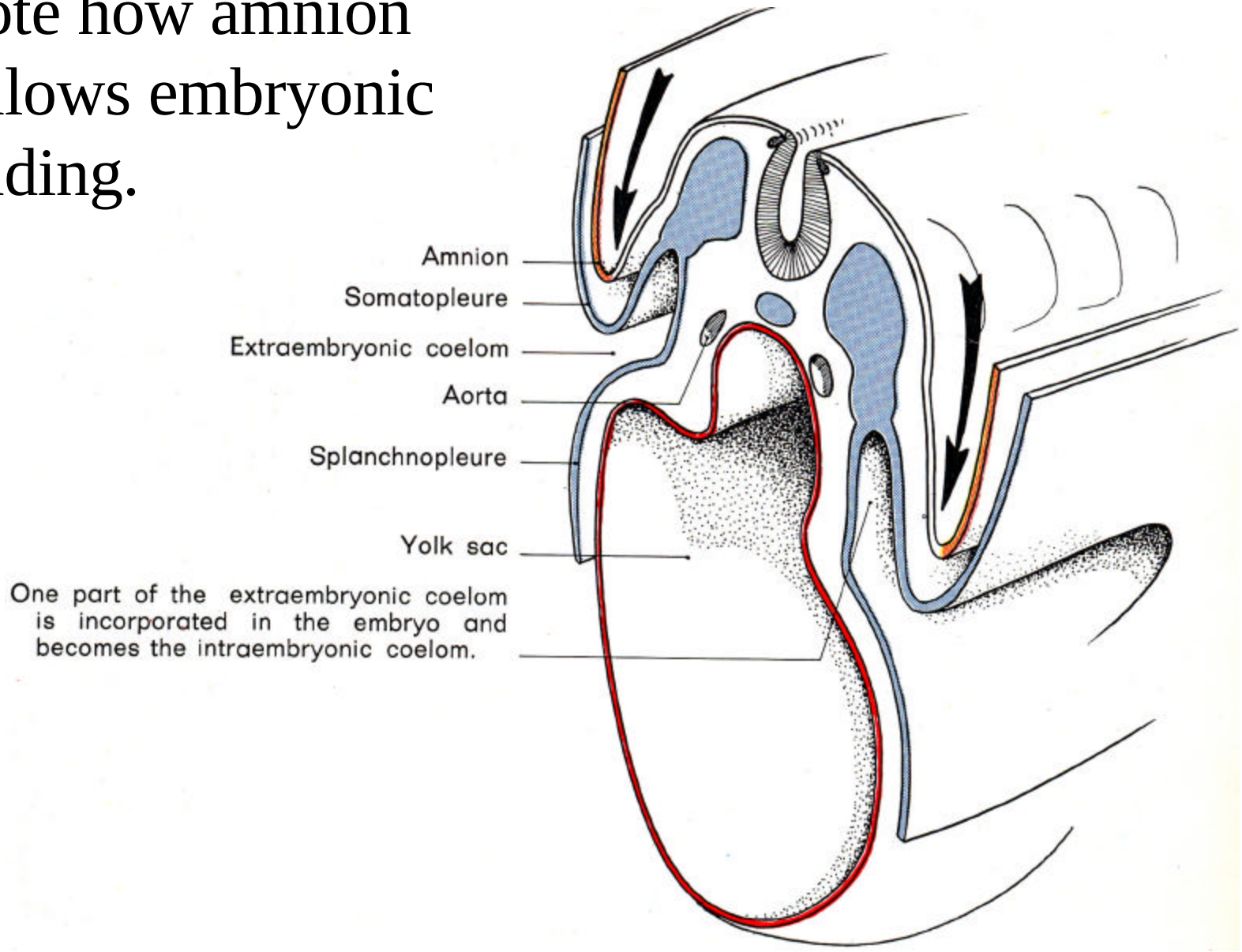
The lateral plate mesoderm splits.

Each leaf will fold toward midline.

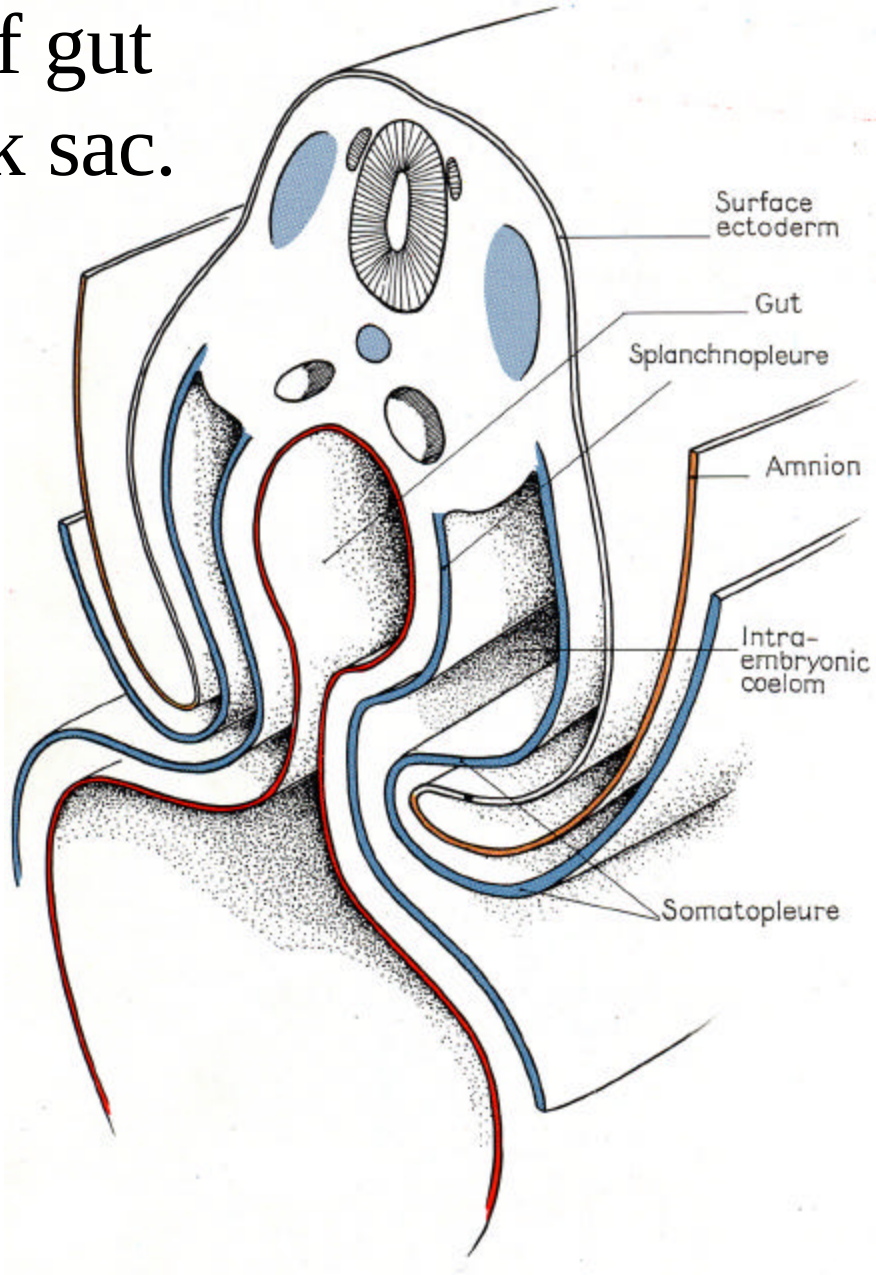
Narrowing yolk sac and gut & enclosing coelom.



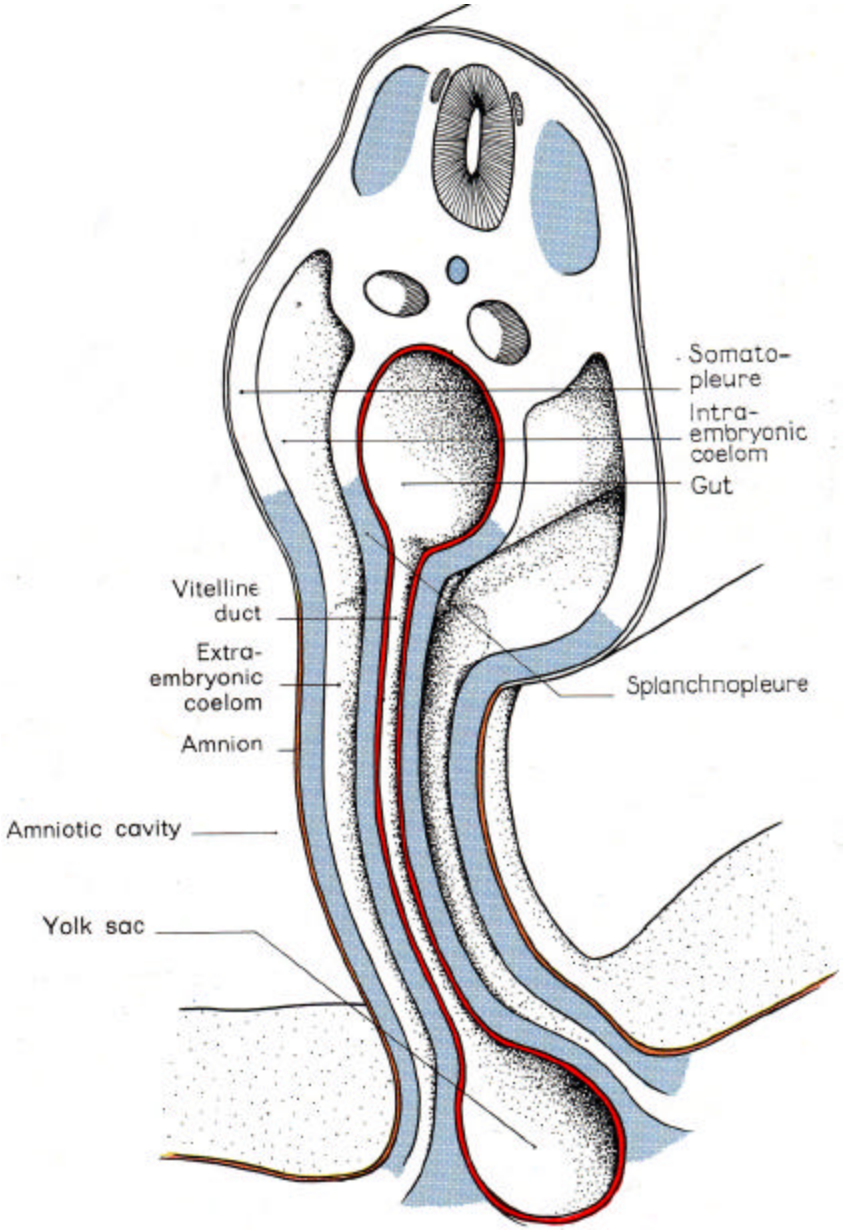
Note how amnion follows embryonic folding.



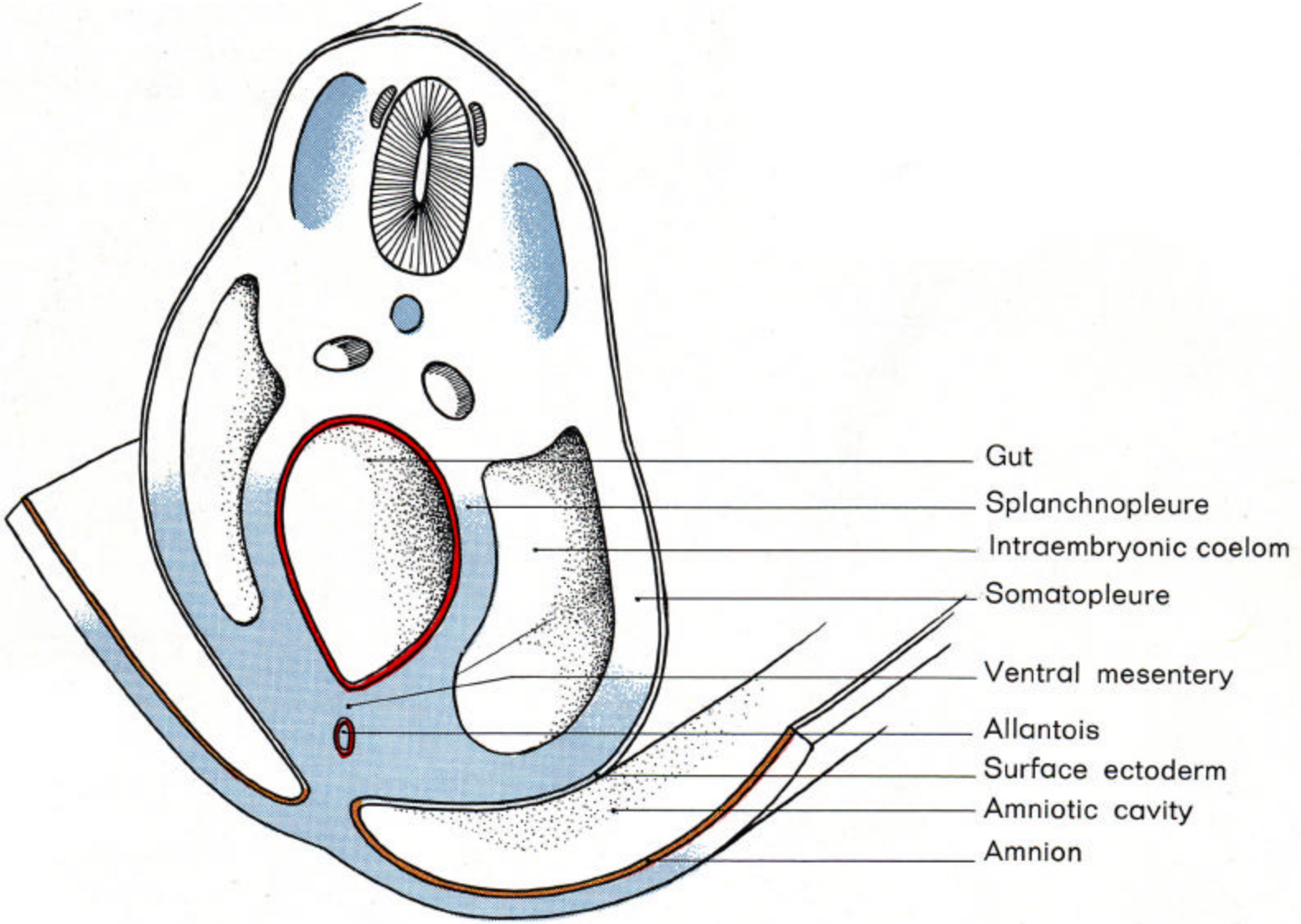
Narrowing of gut tube and yolk sac.



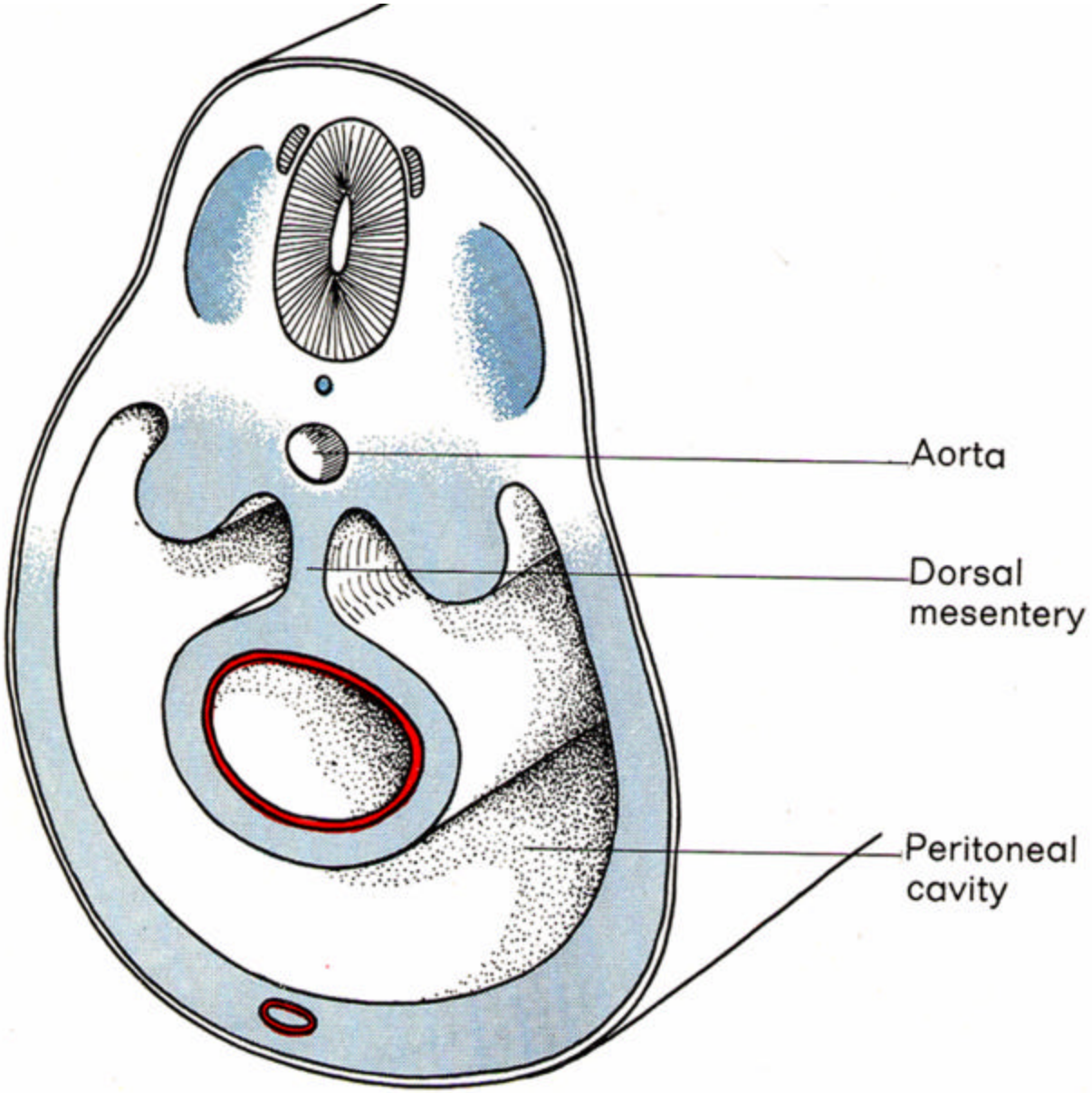
Folding complete: midgut remains open to vitelline duct



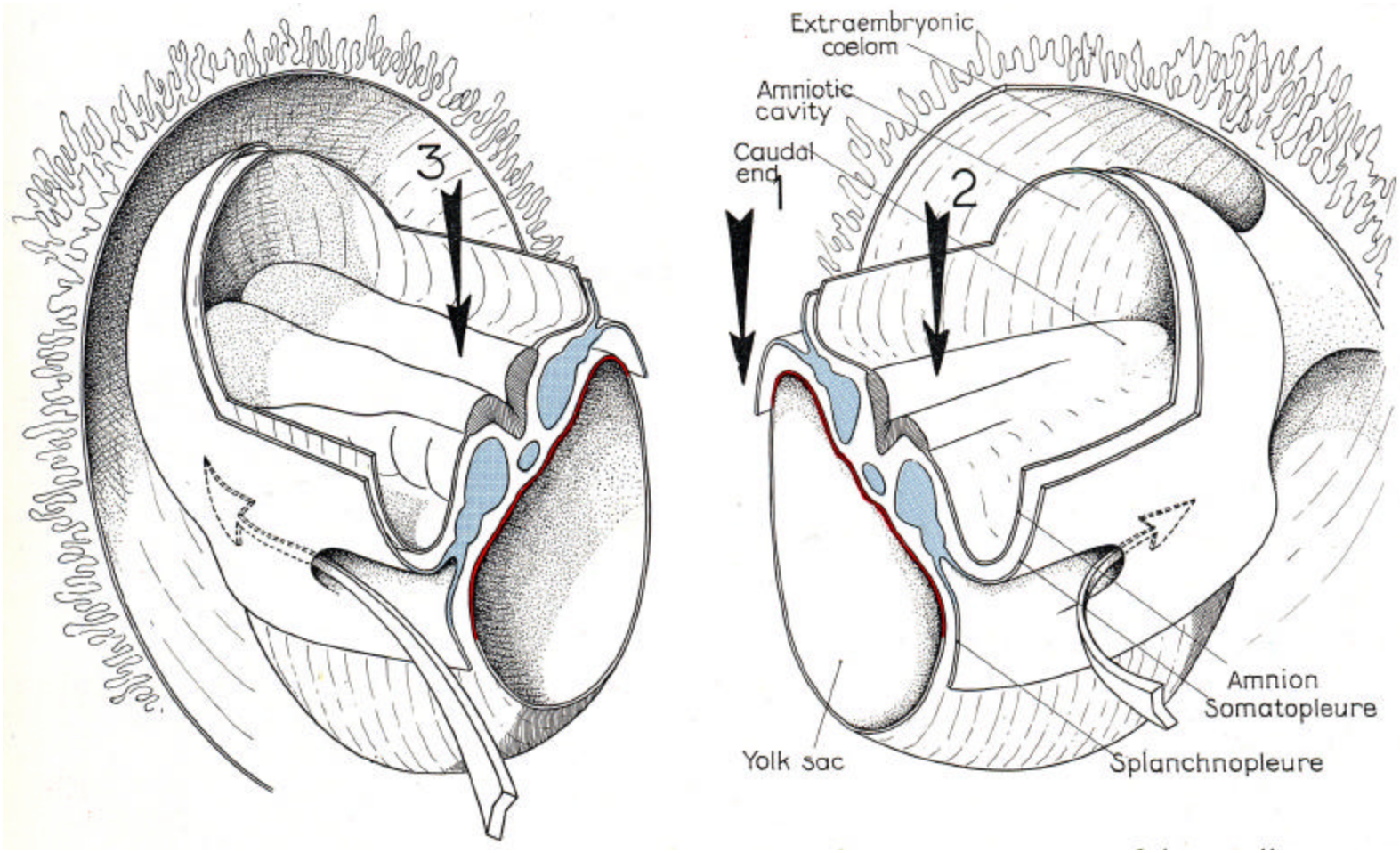
Foregut is initially suspended by dorsal and ventral mesentery.



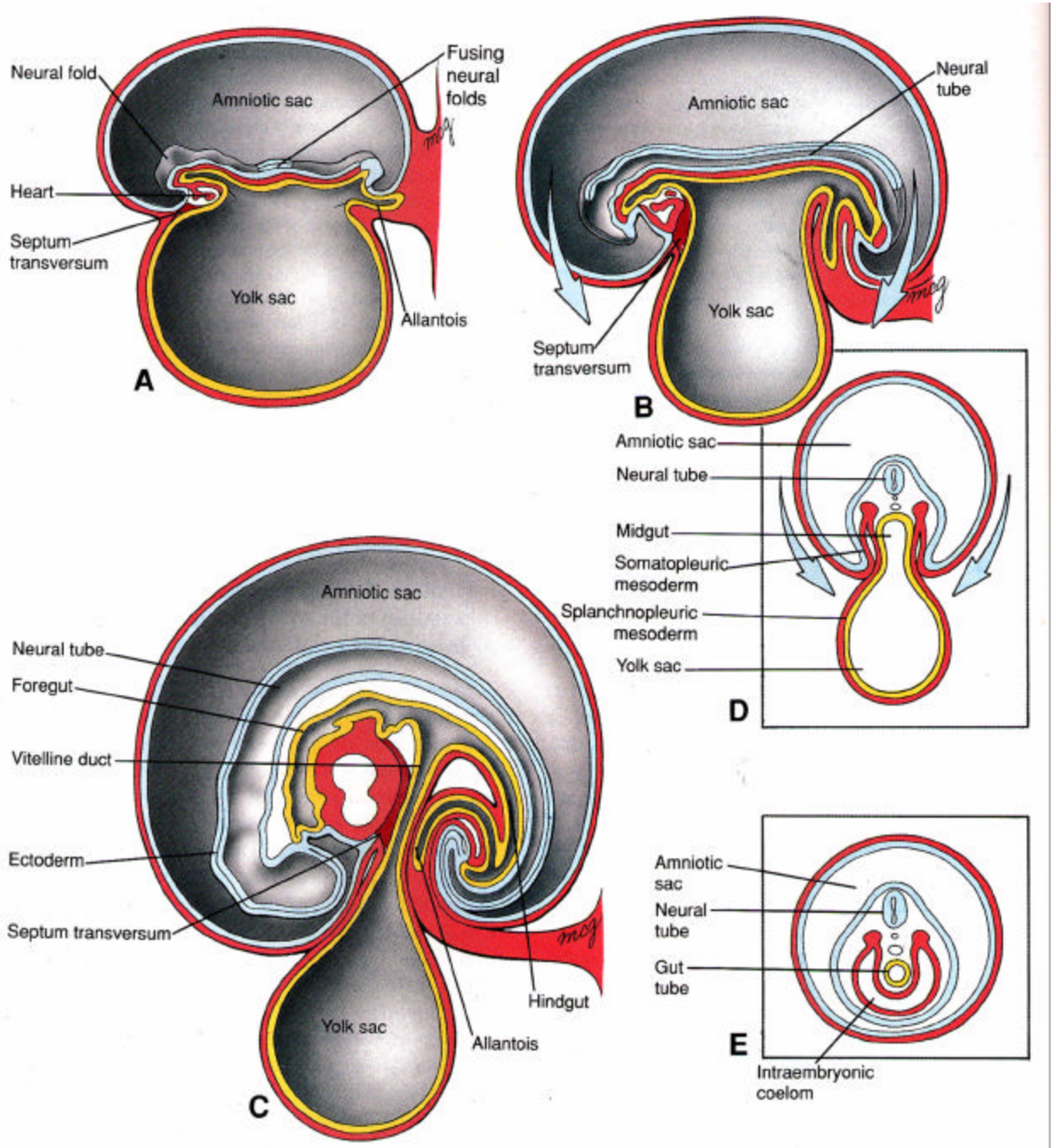
Ventral mesentery reabsorbed. Dorsal remains. Organ in intraperitoneal.

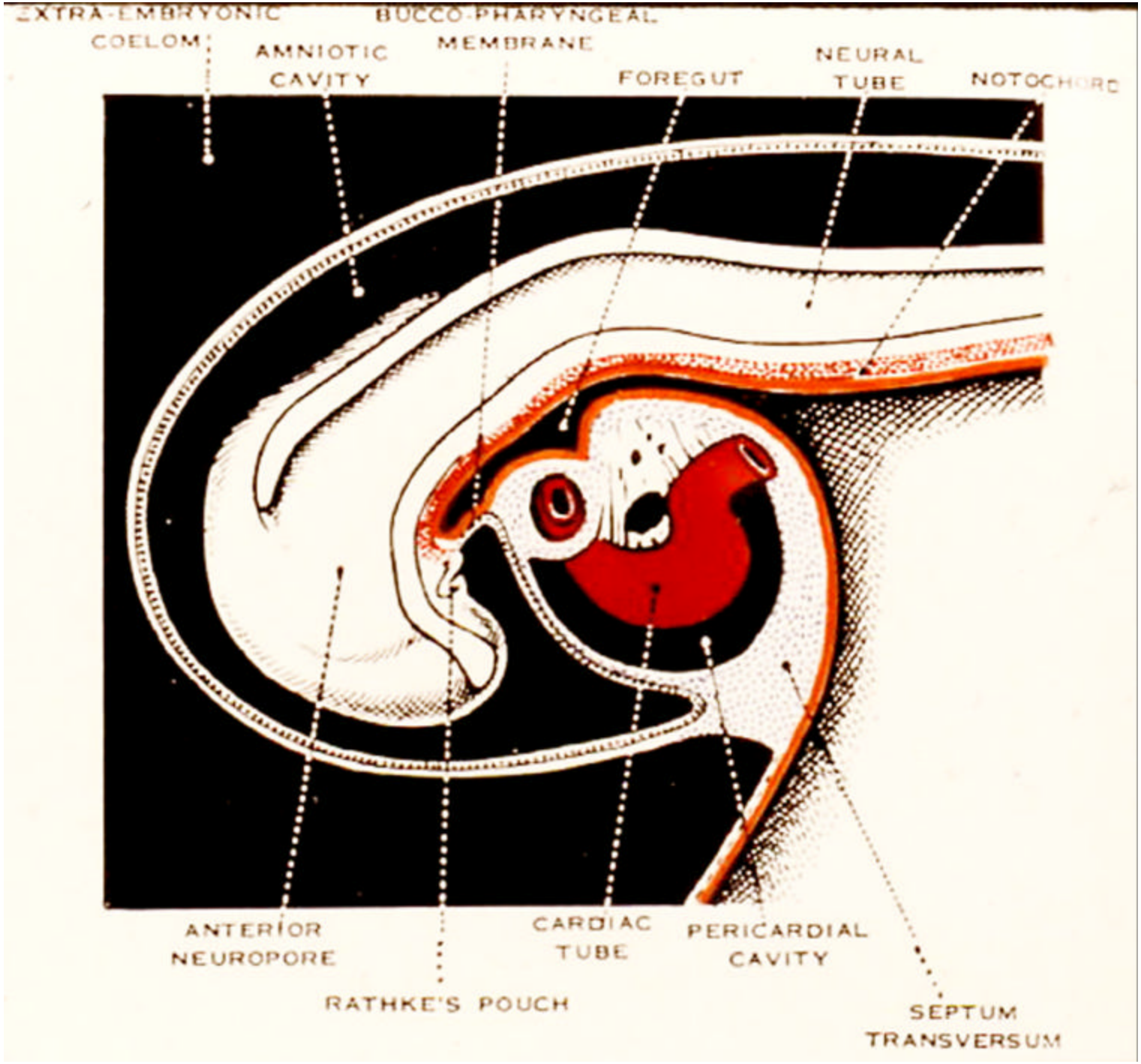


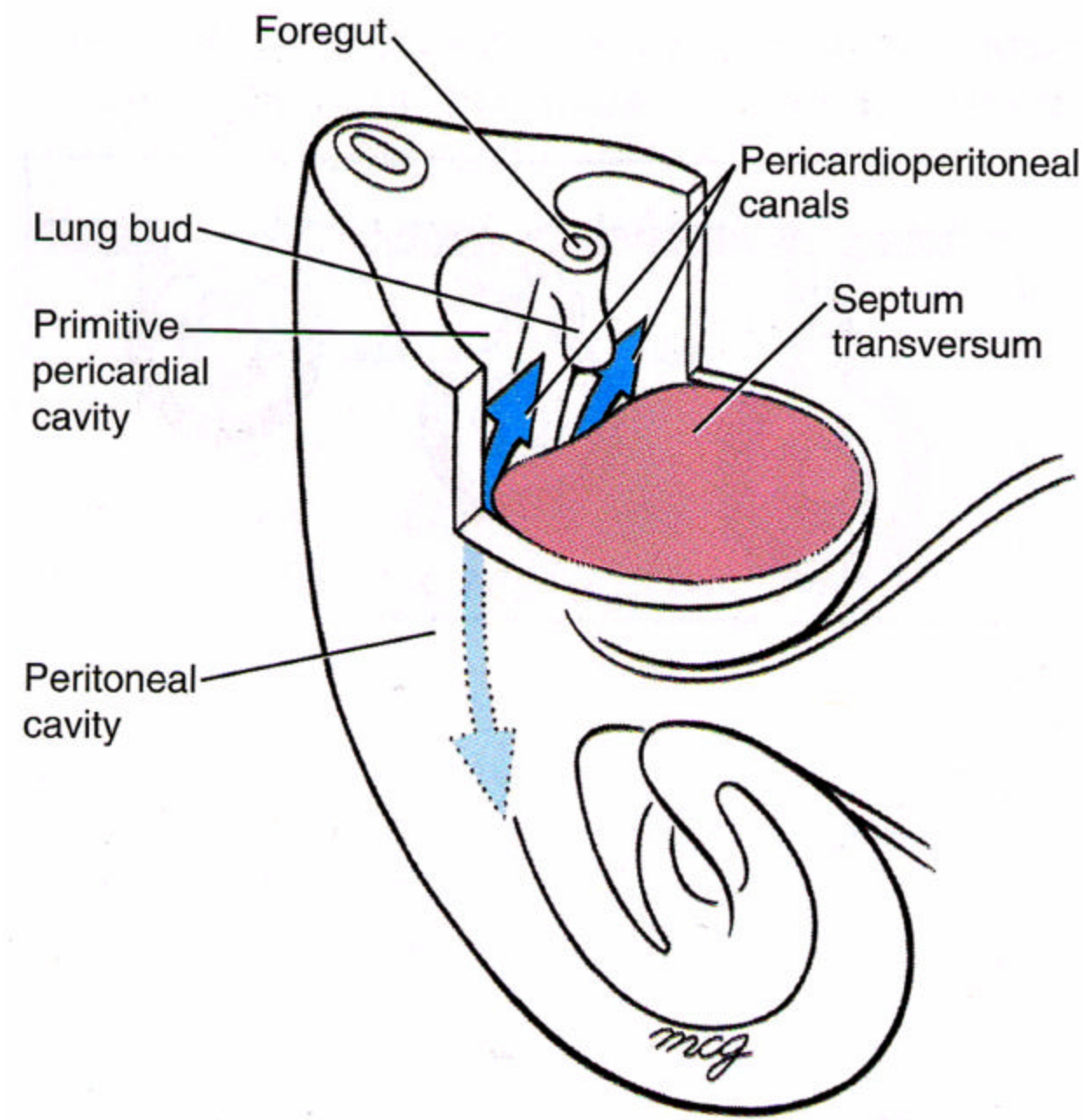
Intraembryonic coelom continues anterior of the heart primordium.

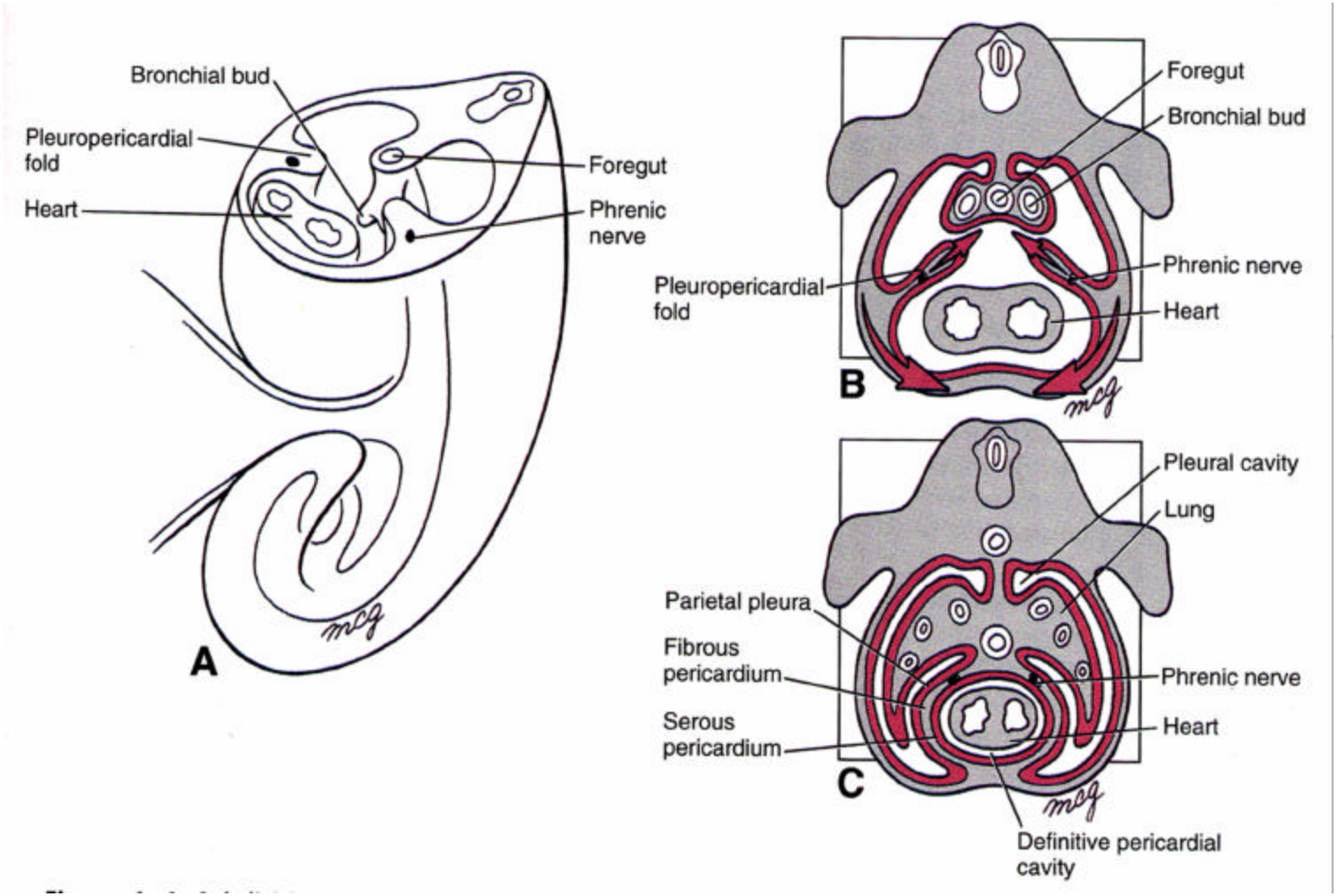


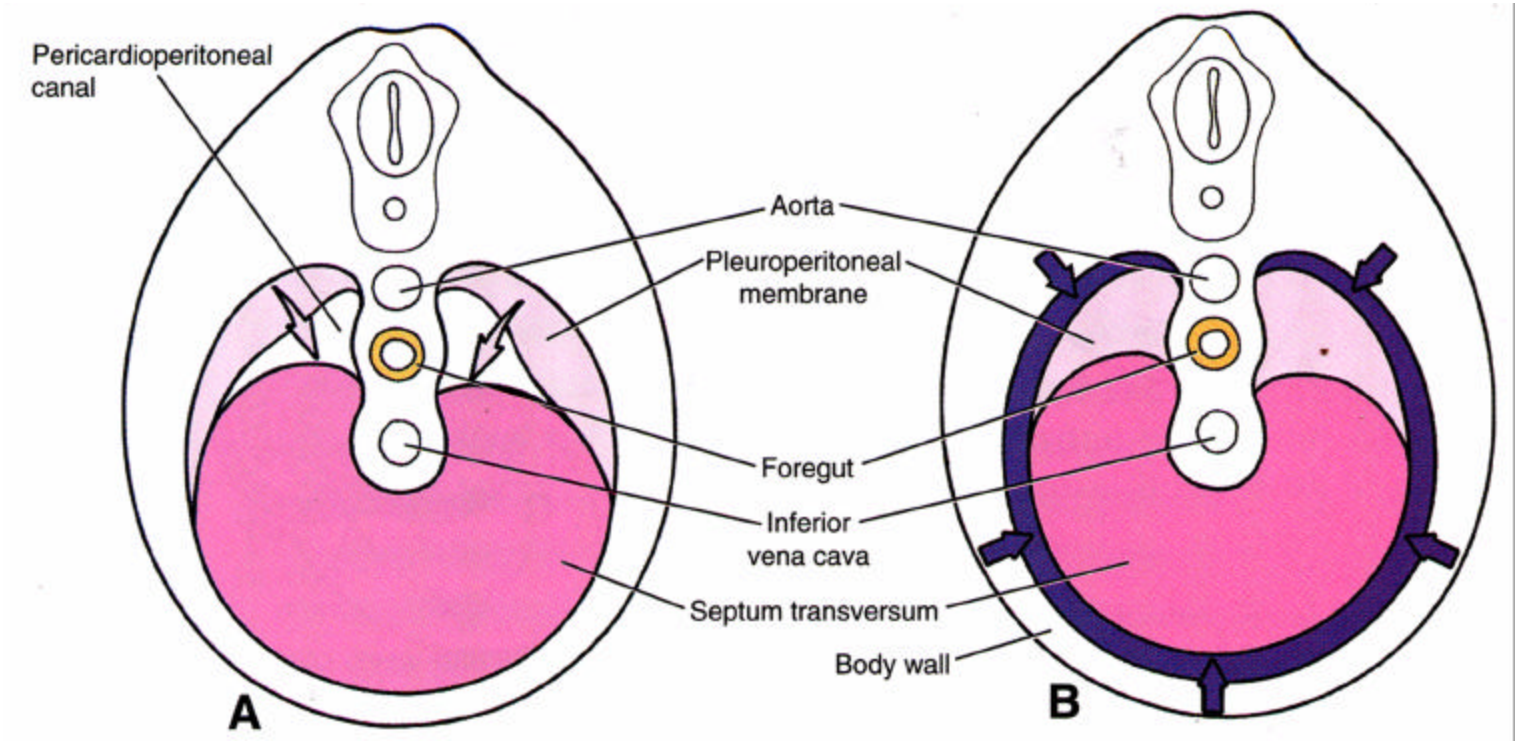
What is different about the embryo after flexion?

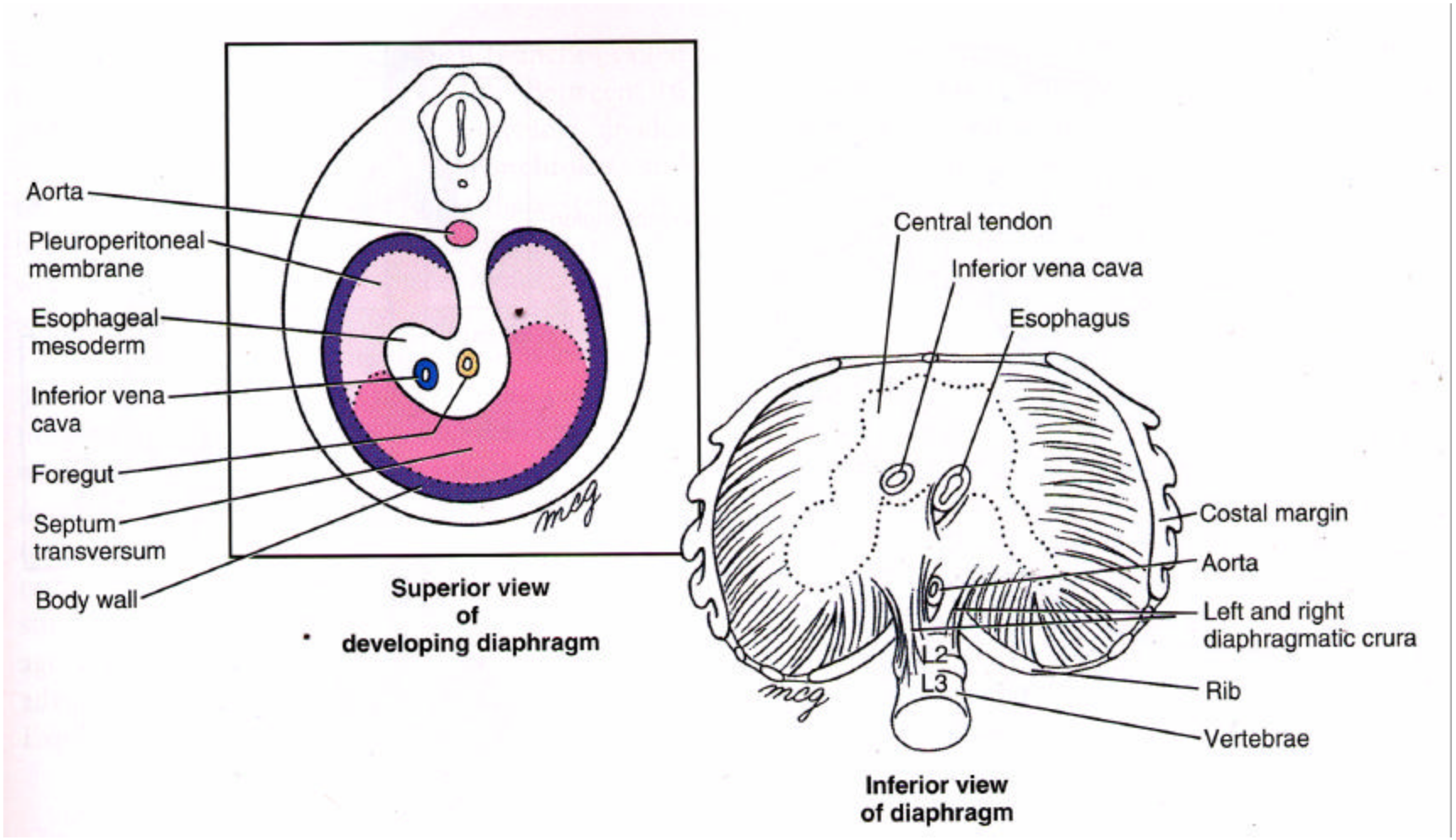



EXTRA-EMBRYONIC COELOM
AMNIOTIC CAVITY
BUCCO-PHARYNGEAL MEMBRANE
FOREGUT
NEURAL TUBE
NOTOCHORD
ANTERIOR NEUROPORE
RATHKE'S POUCH
CARDIAC TUBE
PERICARDIAL CAVITY
SEPTUM TRANSVERSUM

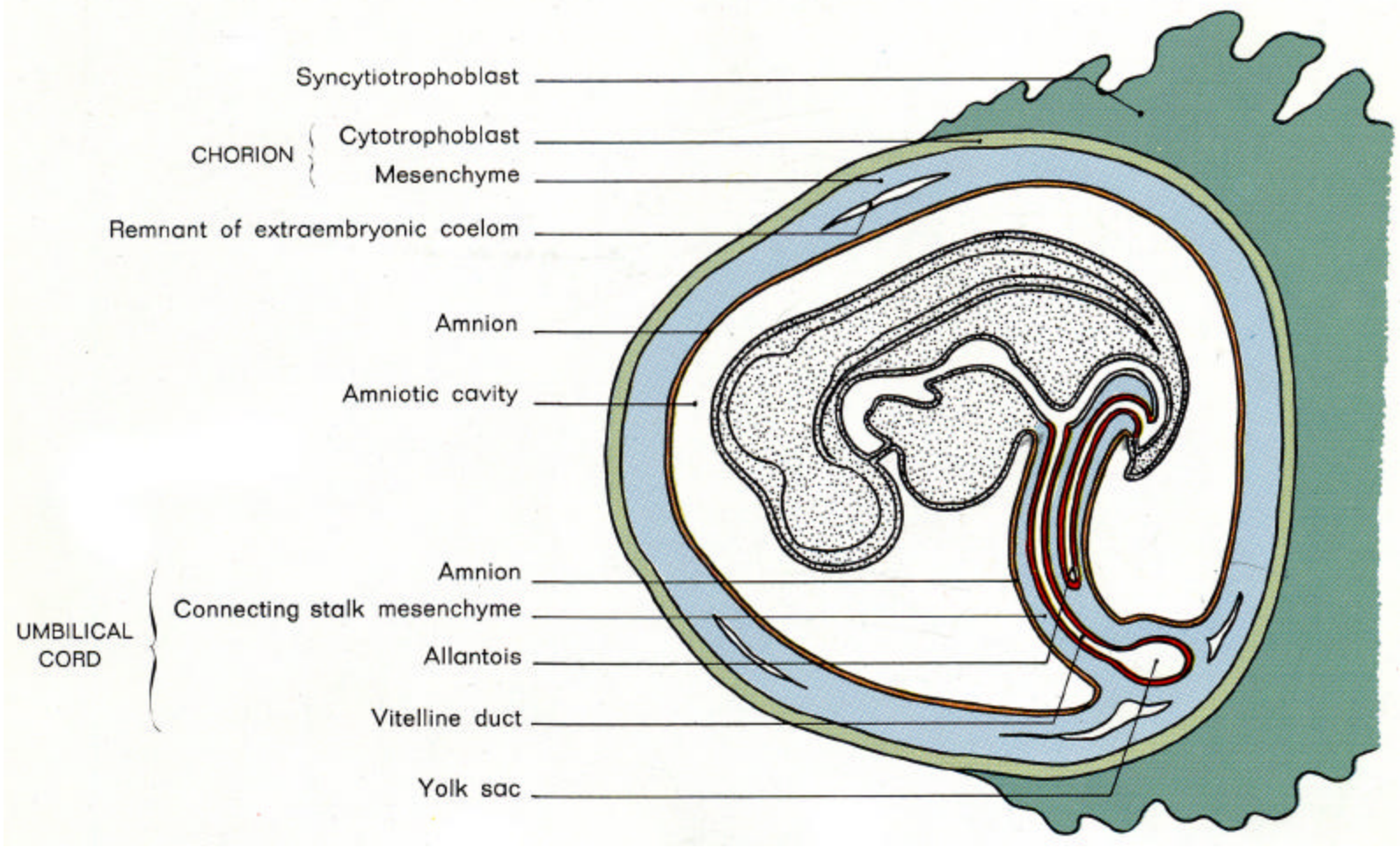

Foregut
Pericardioperitoneal canals
Lung bud
Septum transversum
Primitive pericardial cavity
Peritoneal cavity


Bronchial bud
Pleuropericardial fold
Heart
Foregut
Phrenic nerve
A
Foregut
Bronchial bud
Pleuropericardial fold
Phrenic nerve
Heart
B
Pleural cavity
Lung
Parietal pleura
Fibrous pericardium
Serous pericardium
Phrenic nerve
Heart
C
Definitive pericardial cavity


Pericardioperitoneal canal
Aorta
Pleuroperitoneal membrane
Foregut
Inferior vena cava
Septum transversum
Body wall
A
B



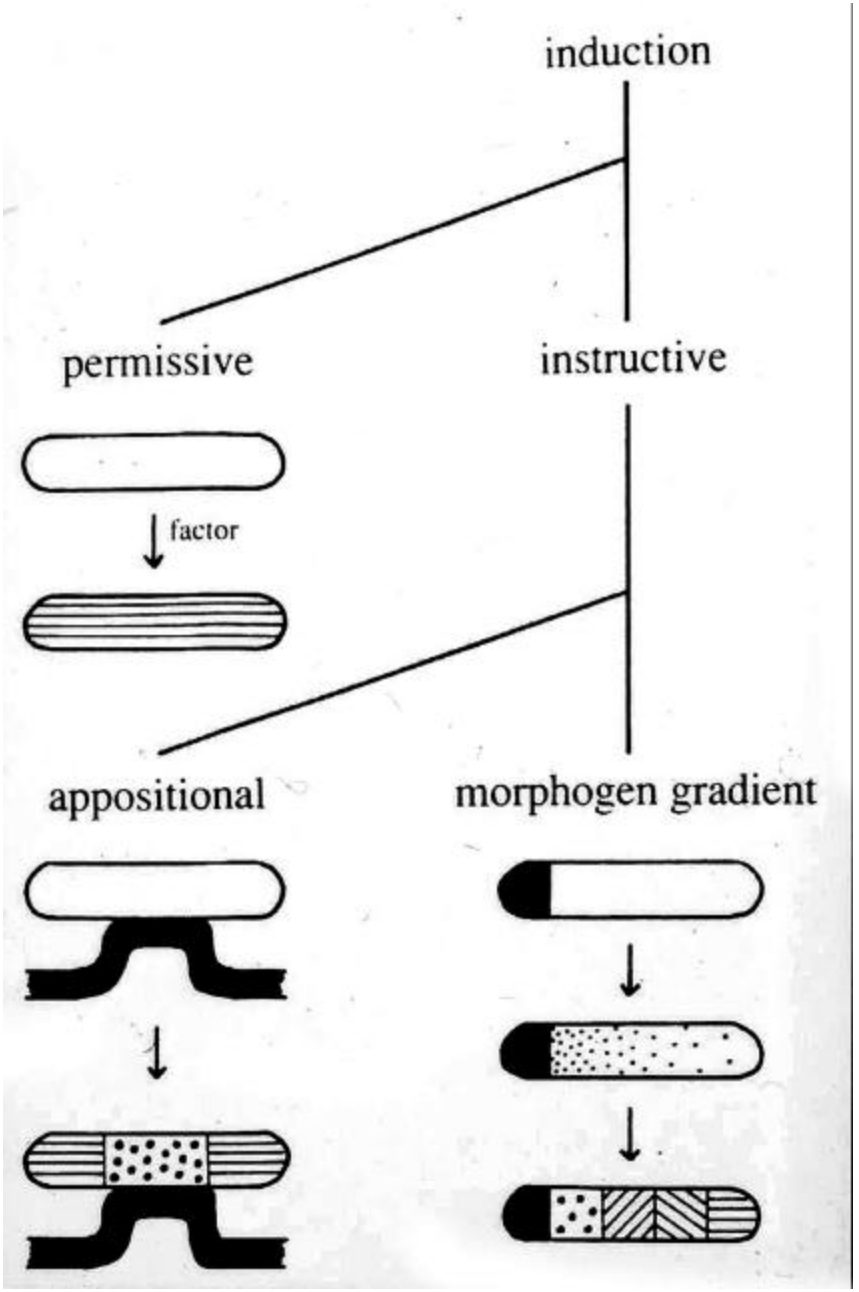
Embryonic sources of adult diaphragm


Syncytiotrophoblast
CHORION
Cytotrophoblast
Mesenchyme
Remnant of extraembryonic coelom
Amnion
Amniotic cavity
Amnion
Connecting stalk mesenchyme
UMBILICAL CORD
Allantois
Vitelline duct
Yolk sac

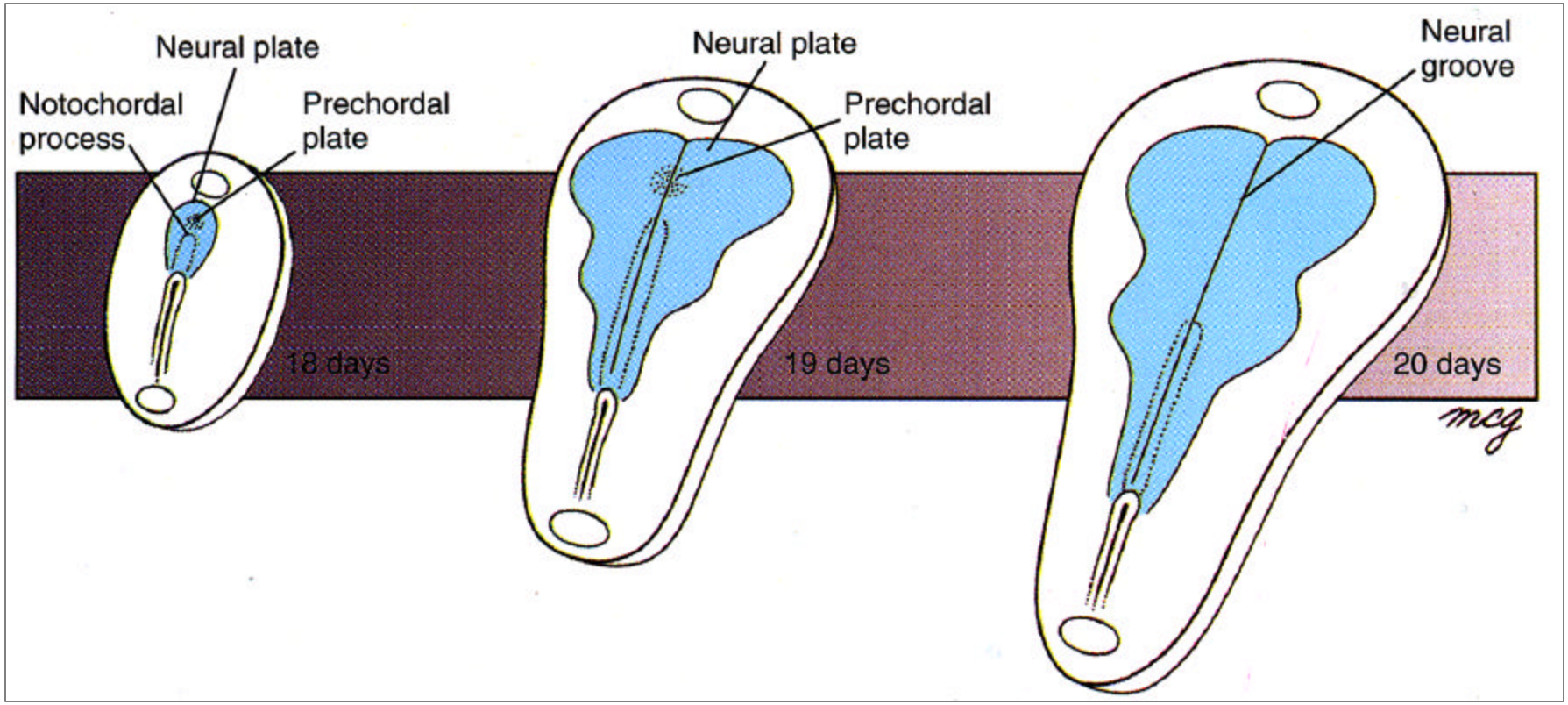
The ectoderm: neurulation, neural tube, neural crest

Neural tissue is said to be induced by mesodermal tissue

Signals divert midline ectoderm from an ectodermal fate.



Shaping the neural plate



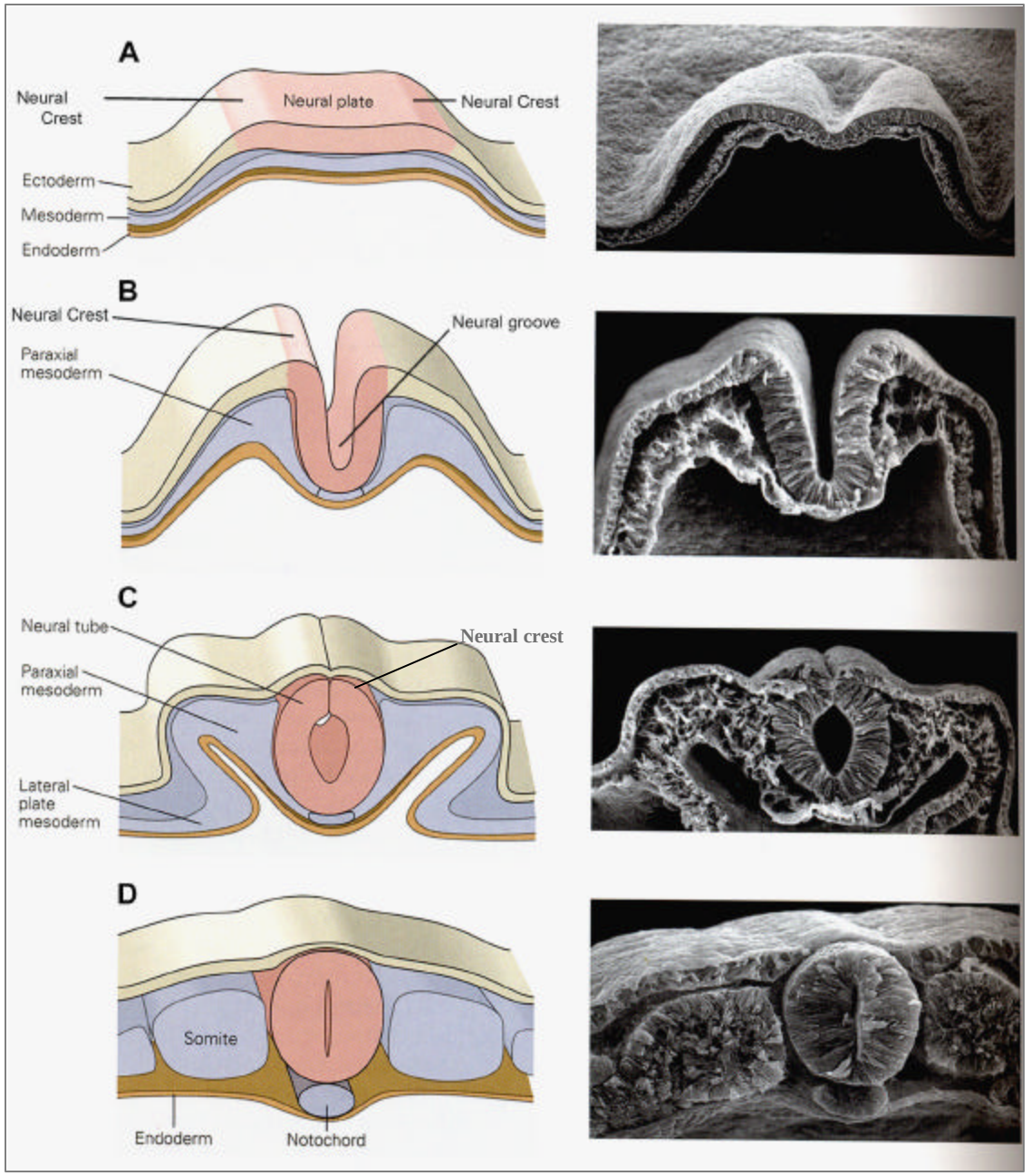
PRIMARY NEURULATION

Neural induction, formation of the neural plate

Formation of of the neural groove and neural folds

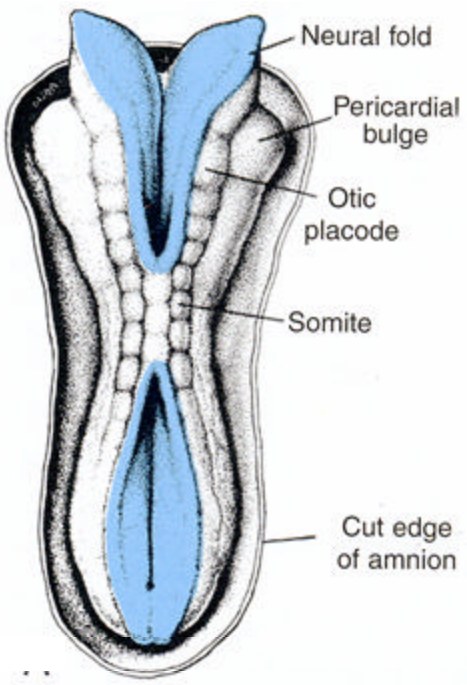
Closure of neural folds, formation of neural tube and neural crest

Initially, the neural tube is composed of a single layer of neuroepithelial cells

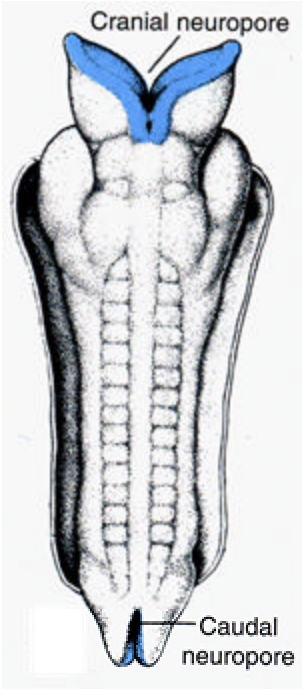


Dorsal view

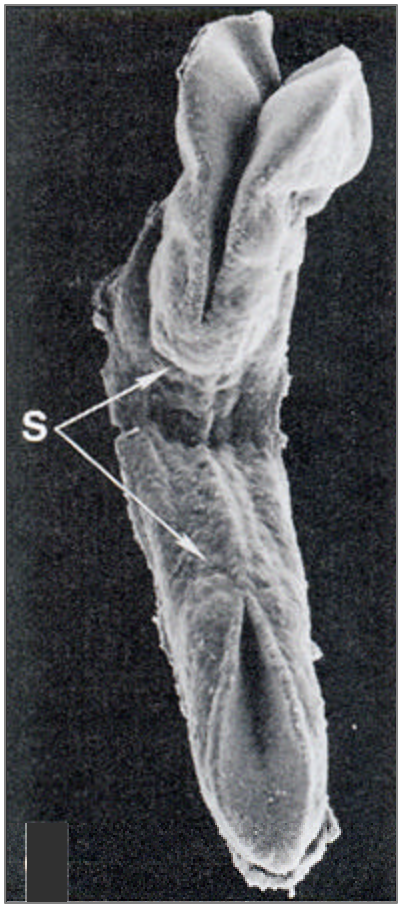
Ventral view

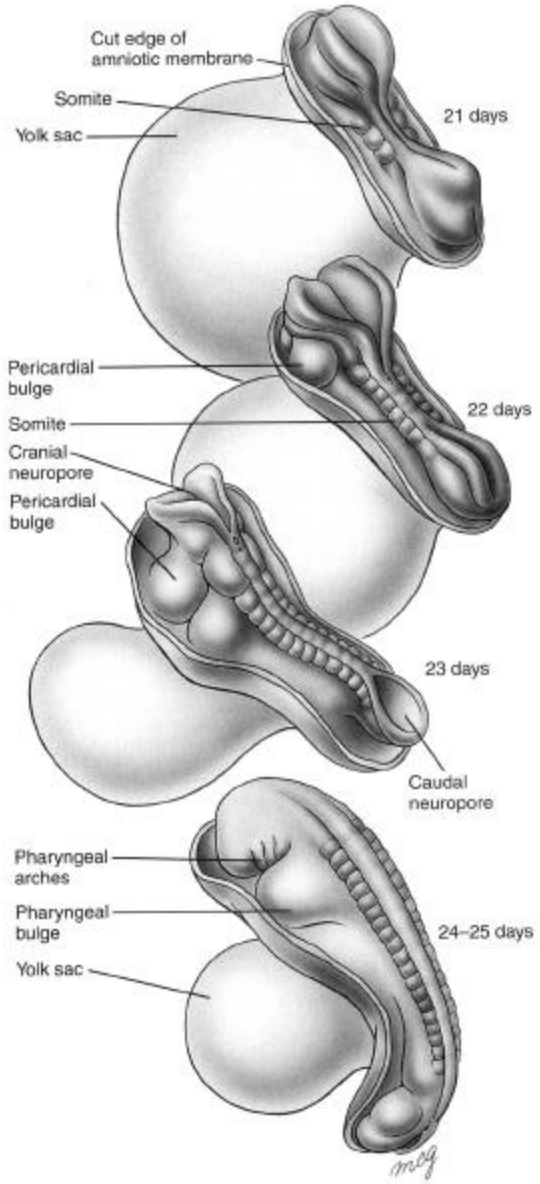


Days 21-22

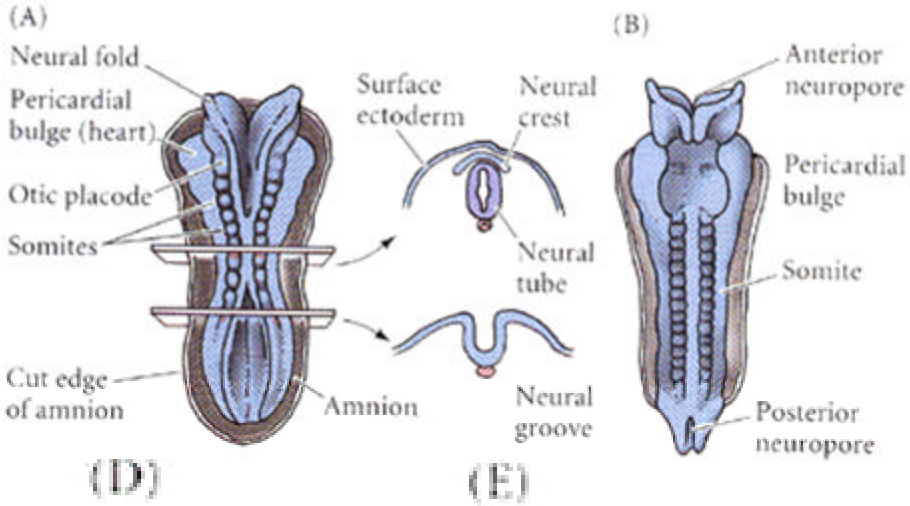


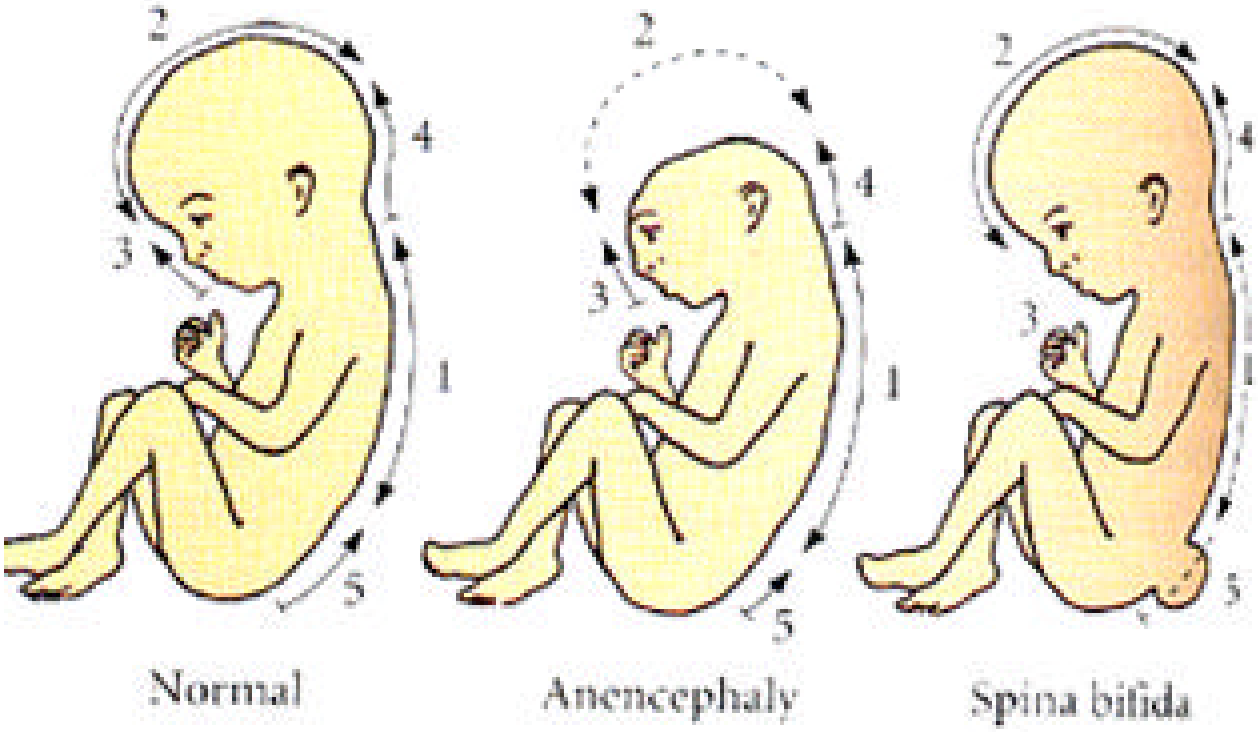
Day 23



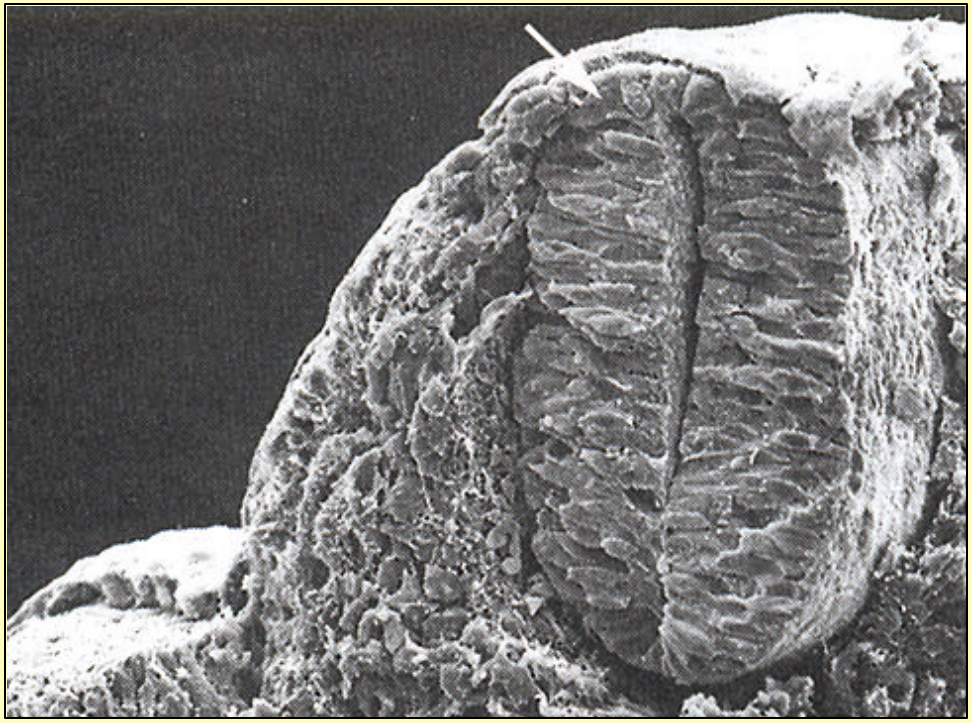

Cut edge of amniotic membrane
Somite
Yolk sac
21 days
Pericardial bulge
Somite
22 days
Cranial neuropore
Pericardial bulge
23 days
Caudal neuropore
Pharyngeal arches
Pharyngeal bulge
Yolk sac
24–25 days
mdg

REGIONS OF NEURAL TUBE CLOSURE





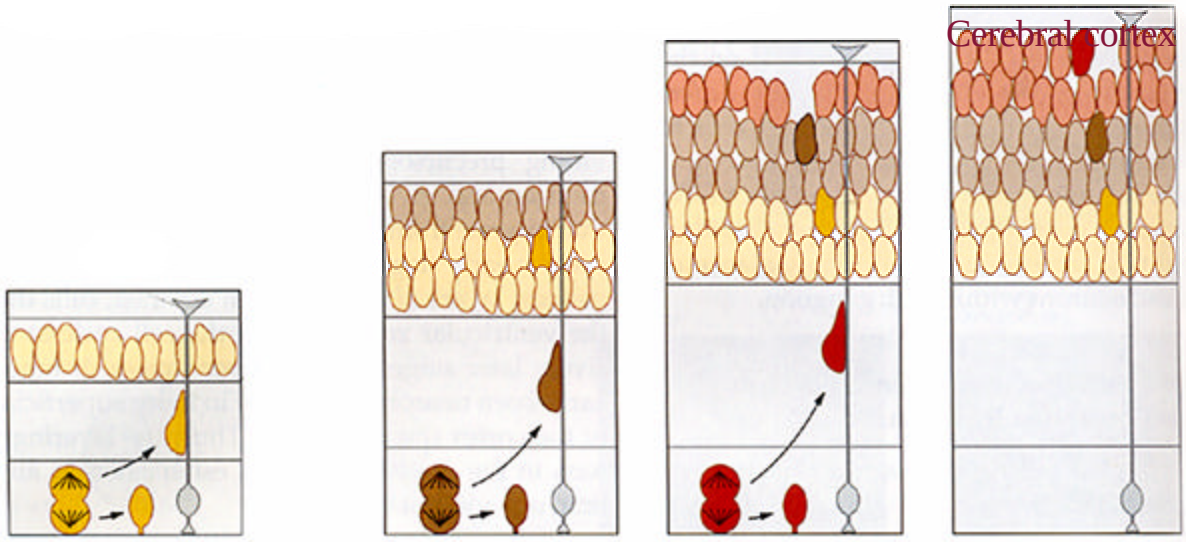
How are billions of CNS cells (neurons and glia) generated?



The neuroepithelium is a layer of rapidly dividing stem cells.

What are the mechanisms for dispersal of cells from the ventricular layer?

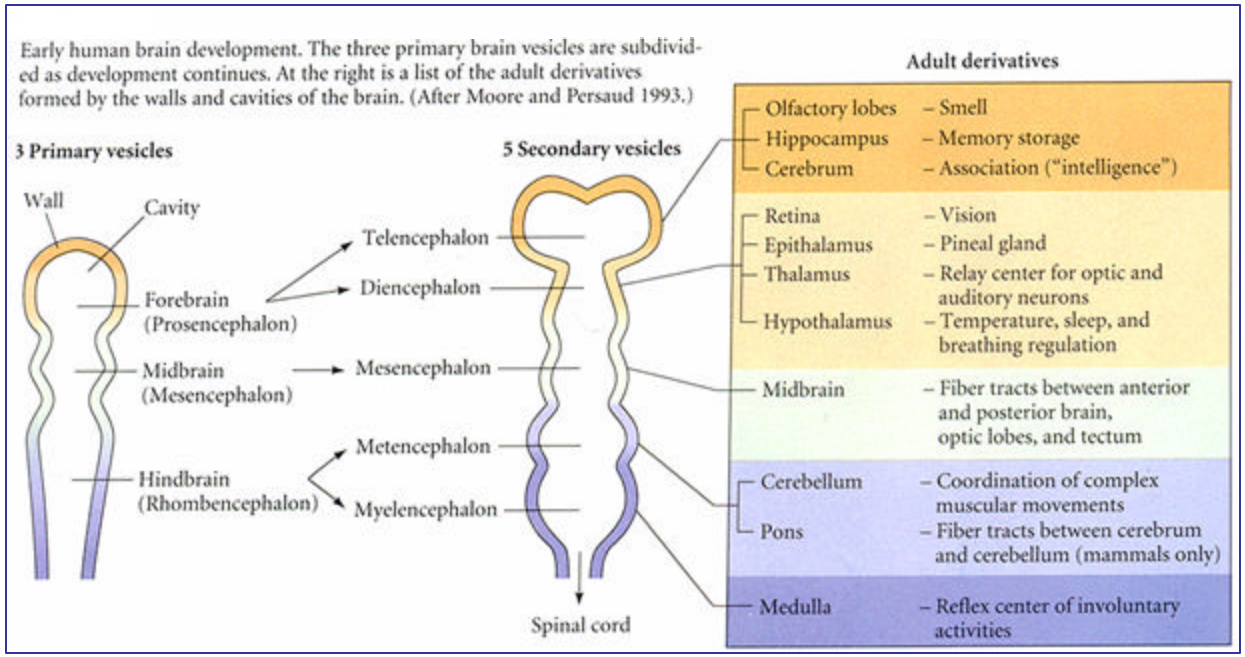
NEUROGENESIS IN THE CEREBRAL CORTEX



1. Developing post-mitotic neuroblasts use special glial cells and their processes as migration paths.
2. Neurons born at early stages migrate to the deepest layers of the cortical plate.
3. Neurons born at later stages form the more superficial layers of the cortex.
4. There are other mechanisms for lateral dispersal.
5. For each region neurons tend to be born before glia.

REGIONALIZATION OF THE CNS

PRIMARY AND SECONDARY VESICLES AND FLEXURES



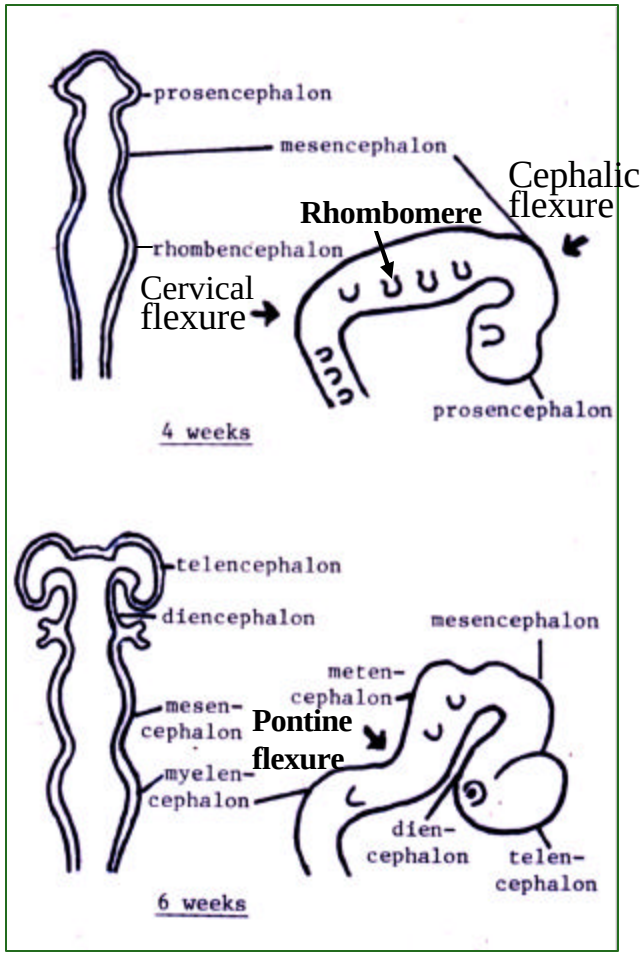
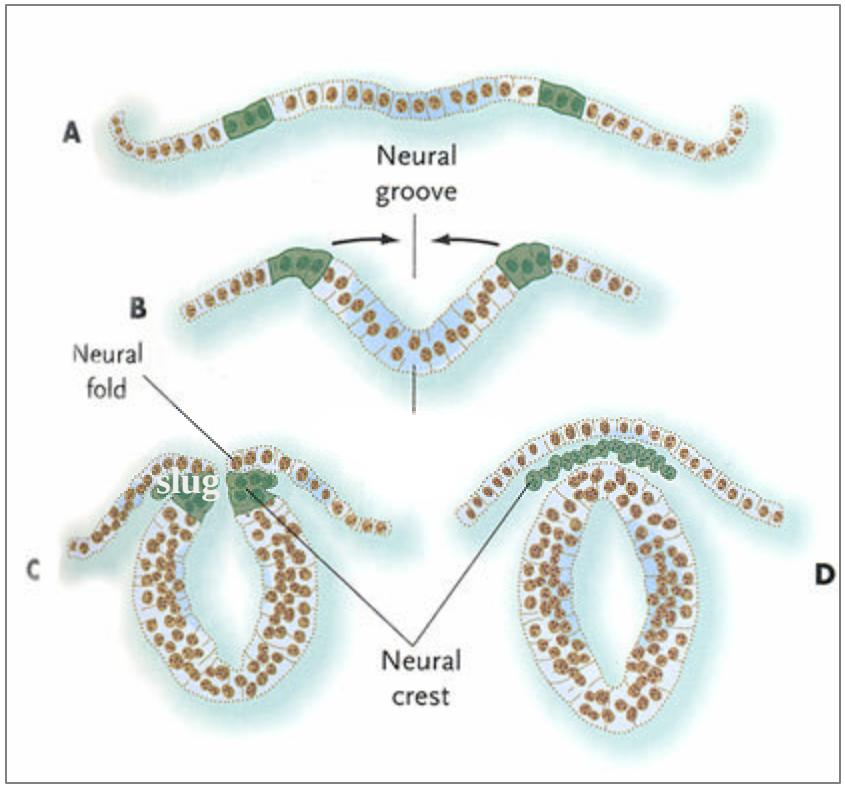


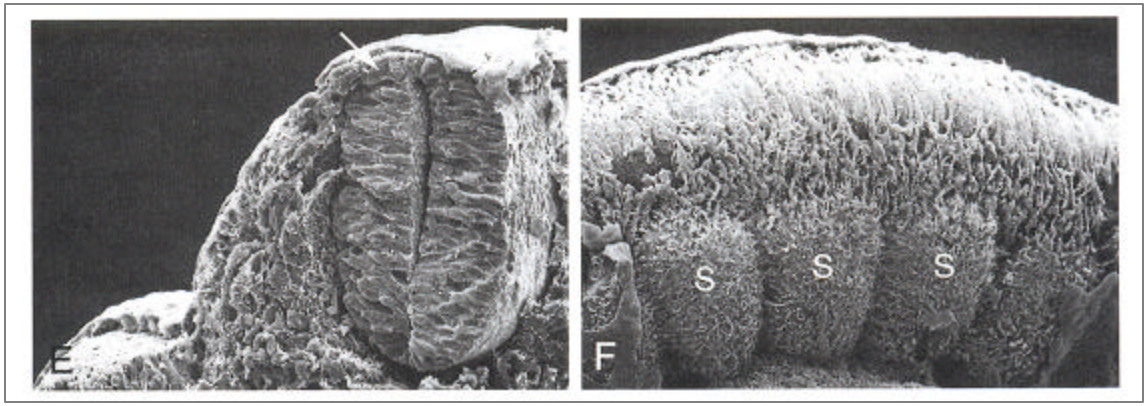
Table 13.1 Some derivatives of the neural crest

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 I cells
Pigment cells	Epidermal pigment cells
Ectomesenchyme	
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.

The neural crest





THE REGION OF THE NEURAXIS FROM WHICH A CREST CELL MIGRATES DETERMINES THE TARGET REACHED BY ITS DERIVATIVES