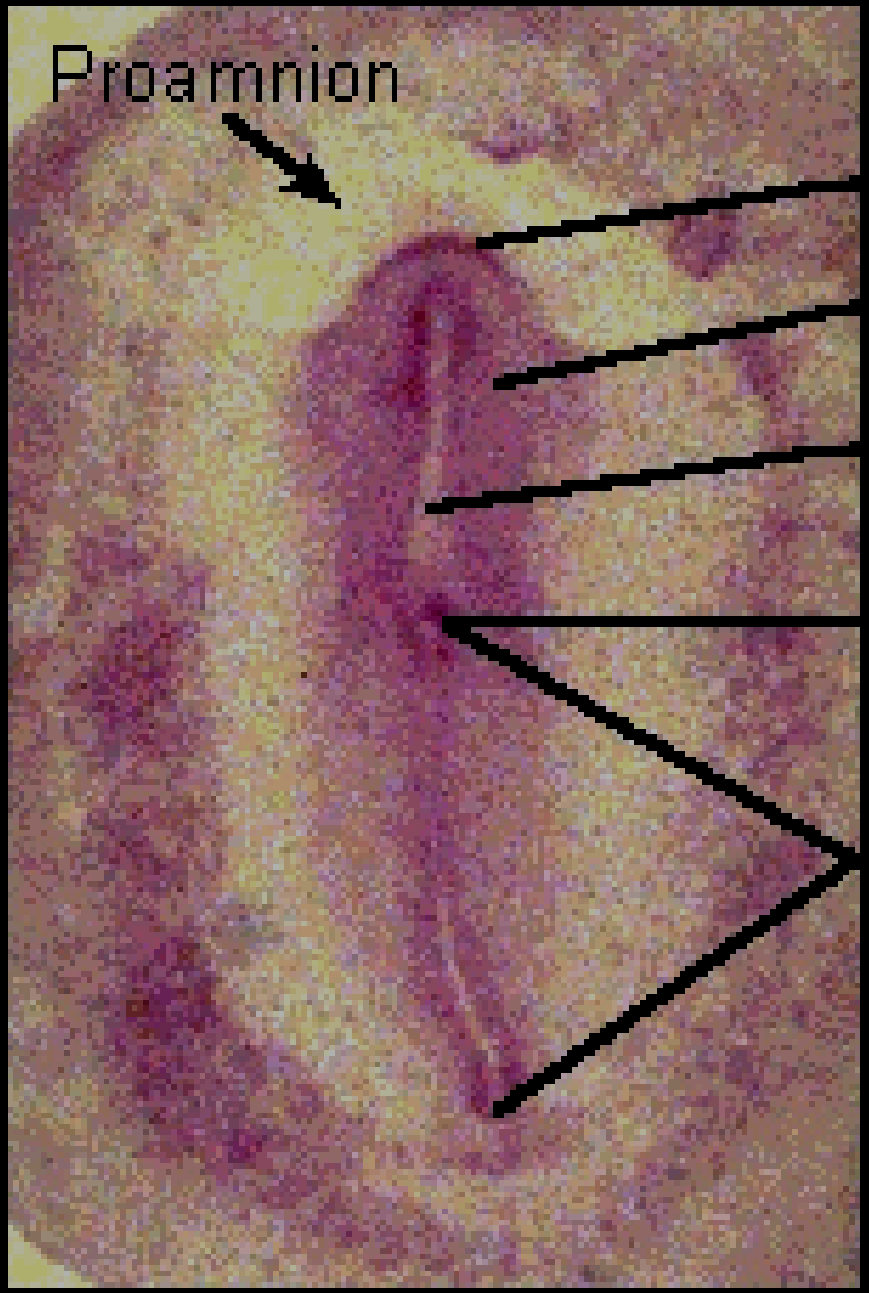
Formation of notochord

The notochordal cells are proliferated from Hensen's node.

The notochordal cells spreads under the epiblast infront of the primitive streak.

Theses cells arrange themselves to form a cylindrical rod called head process or notochordal process.

Head Fold Stage



W.M., 20-21 Hours Incubation

Development of the neural tube

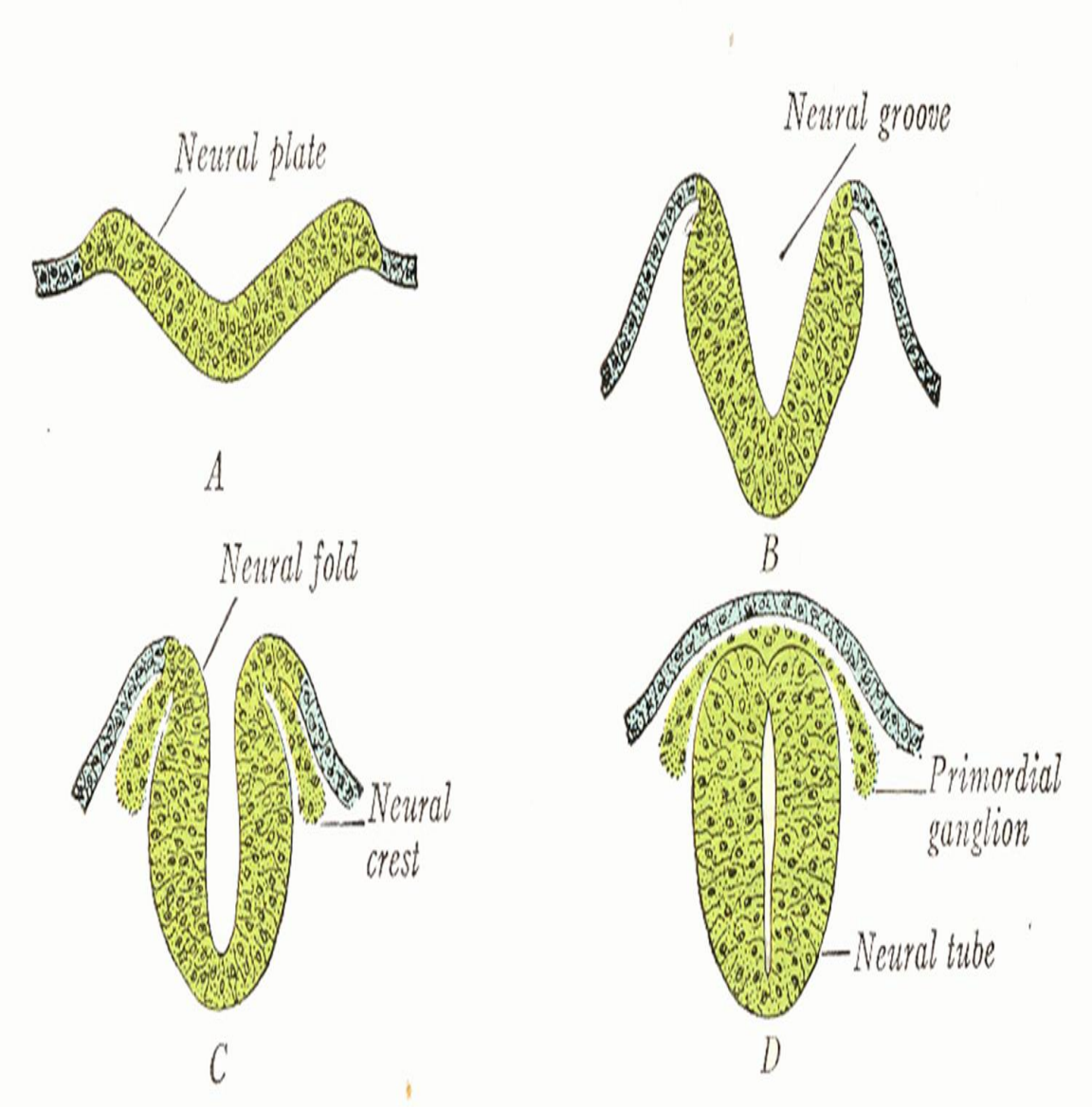
The presumptive material for nervous system, lies on the mid dorsal line as a plate called neural plate.

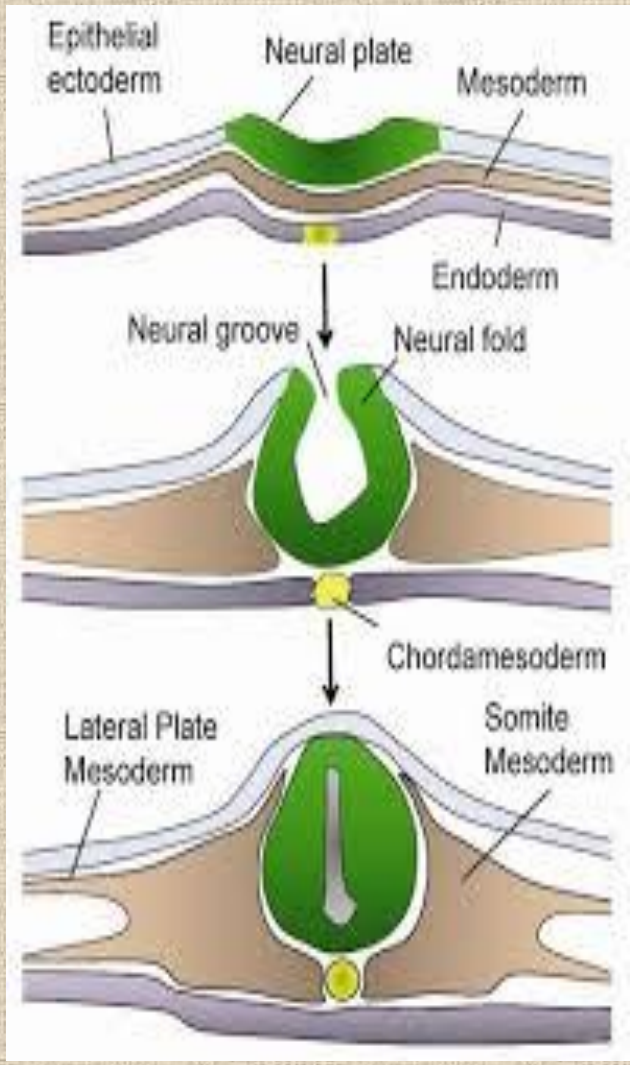
The edges of the plate are folded and elevated. The elevated edges are the neural folds.

The space enclosed by the neural folds is called neural groove.

The neural folds increase their elevation and converge towards the mid dorsal line until they meet and fuse. As a result a tubular structure is produced. It is called neural tube.

Development of the neural tube





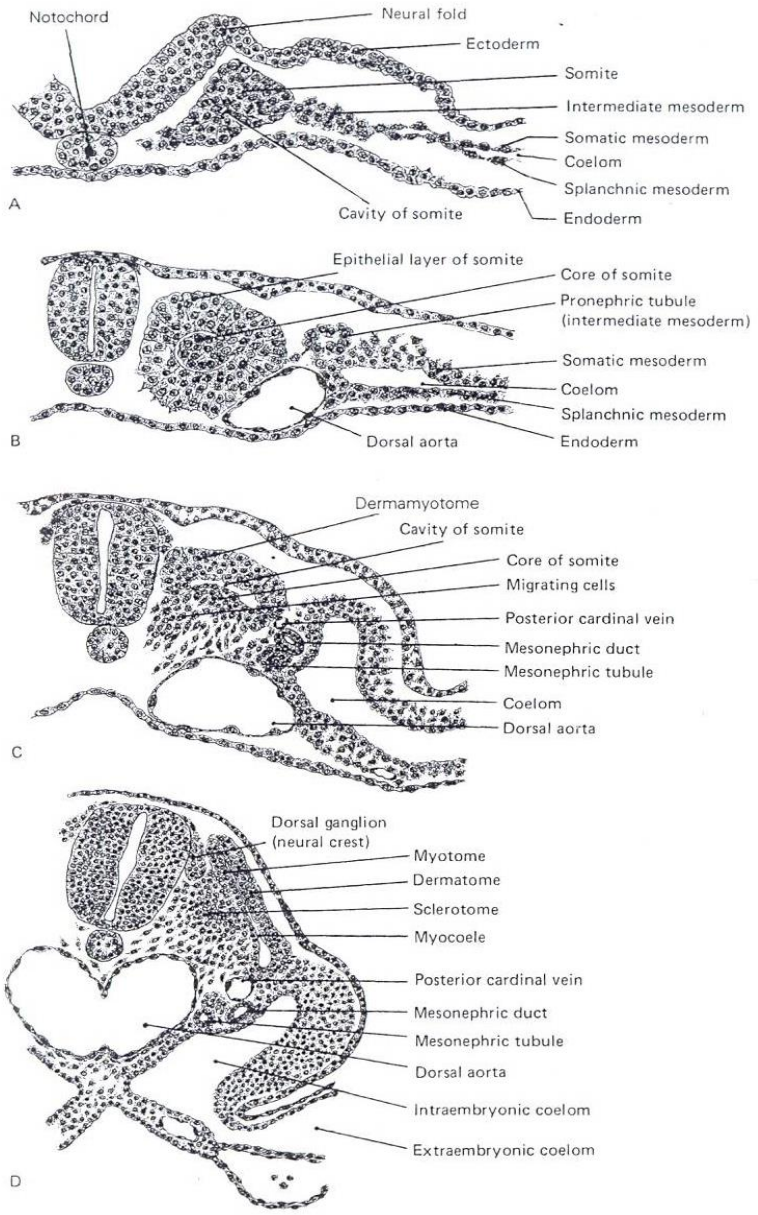


FIGURE 7-18
Drawings from transverse sections to show the differentiation of the somites. (A) Second somite of a 4-somite chick (about 24 hours); (B) ninth somite of a 12-somite chick (about 33 hours); (C) twentieth somite of a 30-somite chick (about 55 hours); (D) seventeenth somite of a 33-somite chick (about 2½ days).

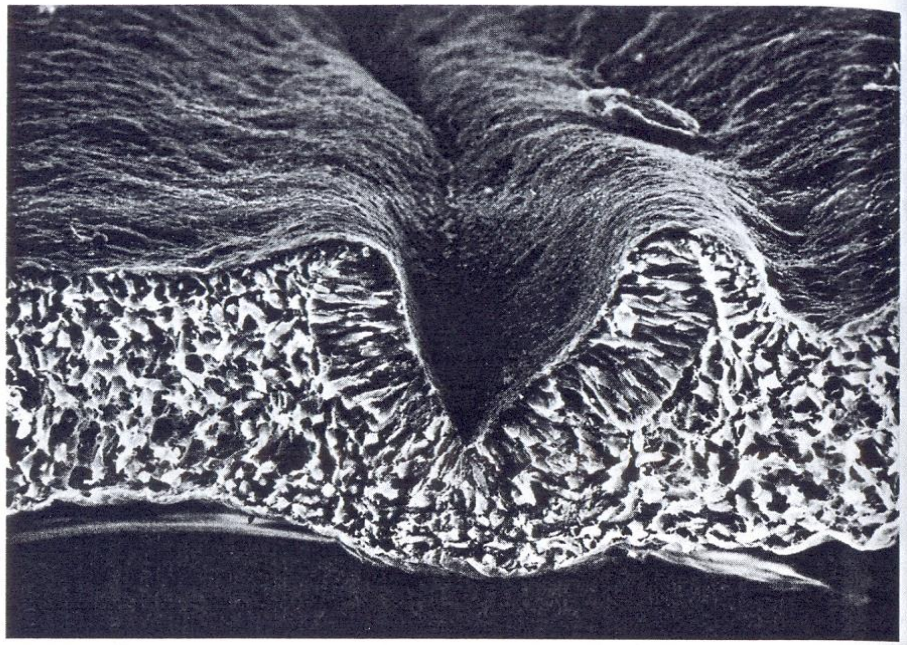


FIGURE 7-16
Scanning electron micrograph of a cross-sectioned chick embryo, showing the prominent neural folds (*center*). The regularity of the ectodermal cells of the thickened neuroepithelium stands out in sharp contrast to the meshwork of mesodermal cells beneath the surface epithelium. (*Courtesy of K. Tosney.*)

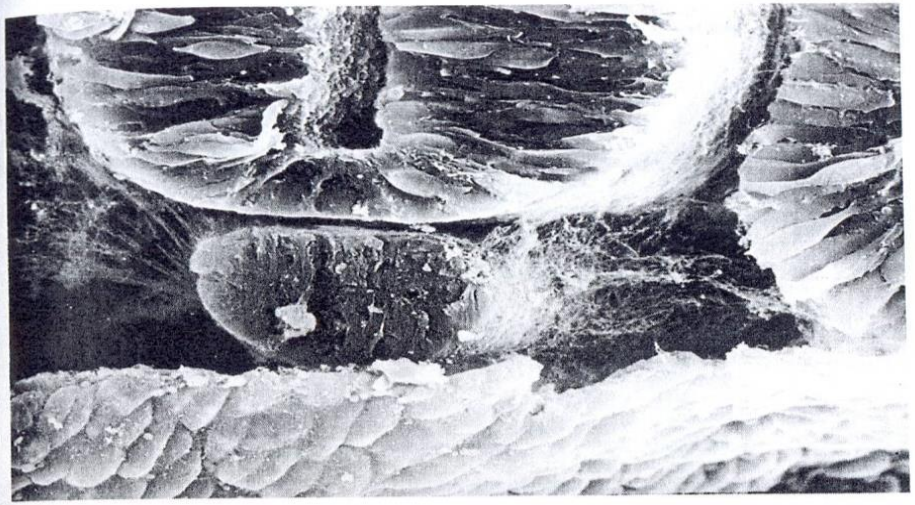
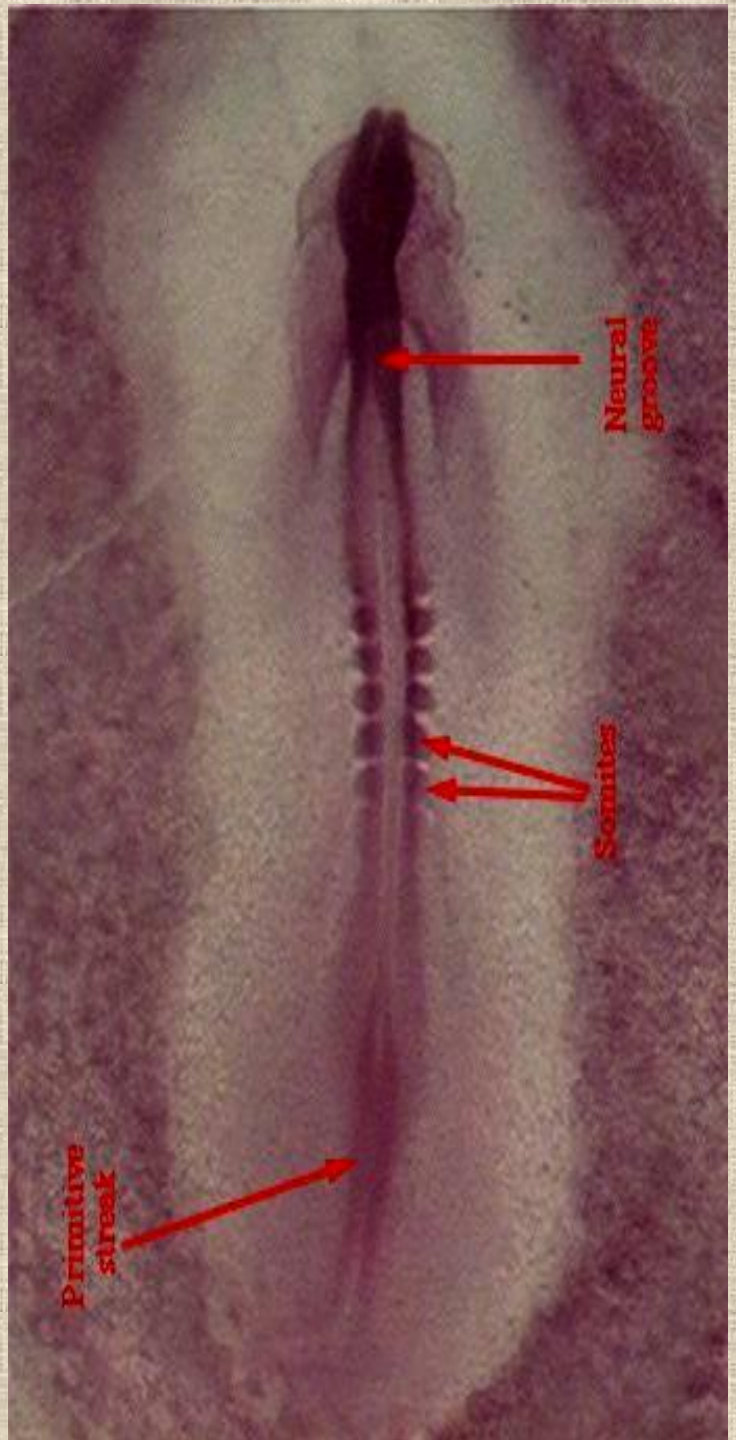


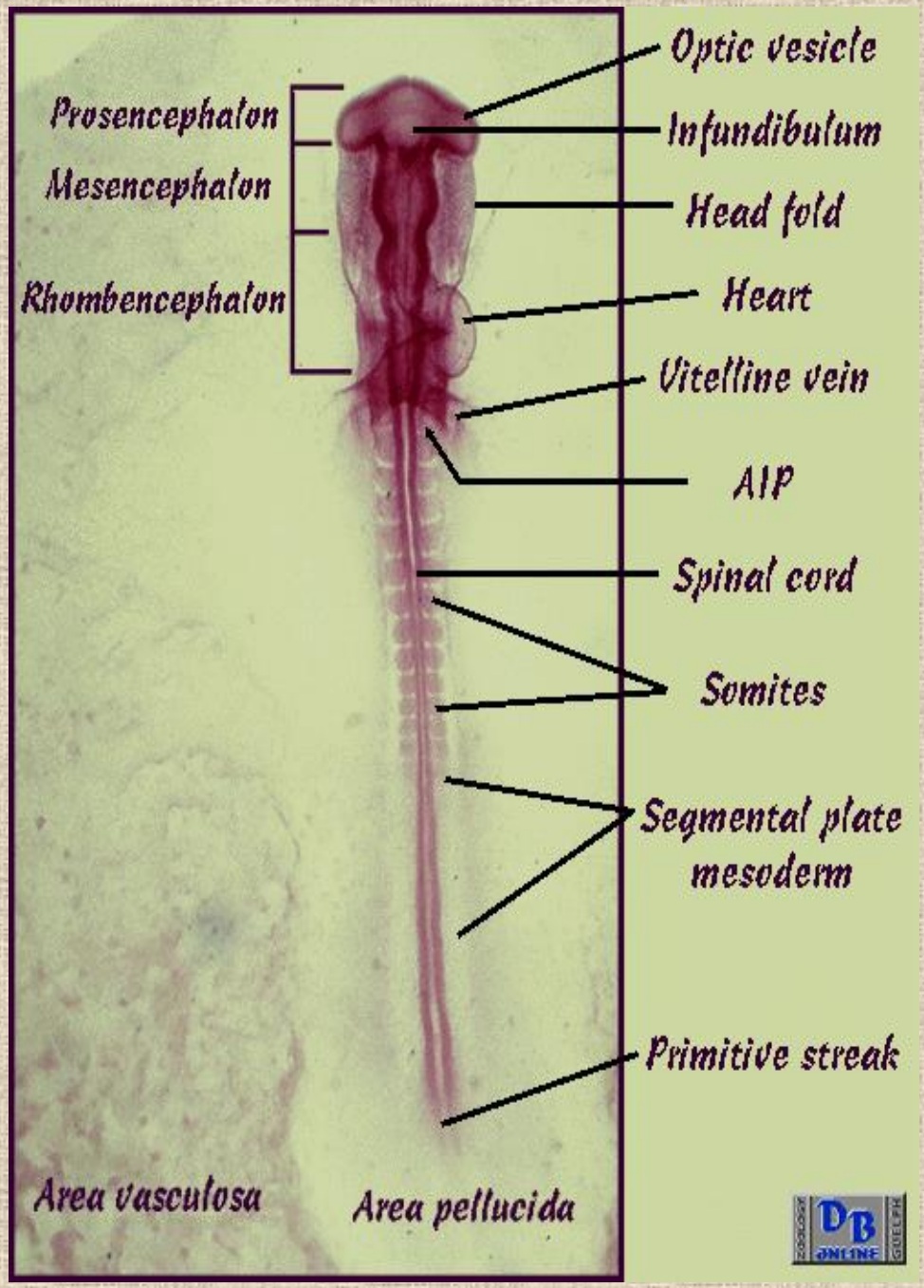
FIGURE 7-19
Scanning electron micrograph showing the neural tube (*top*), notochord (*middle*), and part of a somite (*right margin*) of a chick embryo. Alongside the neural tube and notochord a tangled webbing of fibrillar components of the extracellular matrix plays an important role in cell migrations and cellular interactions in the area. (*Courtesy of K. Tosney.*)

-As the development of the embryo continued, the flexures in the region of brain occur and the brain grows rapidly.

-During the second day the second day the fore-and mid-brains becomes differentiated due to the appearance of cranial flexure.



-Finally by the end of second day the secondary cervical flexure demarcate the hind brain also. In the subsequent stages of development, this simple brain becomes completely differentiated.



Sense organs

Development of the eye

At first , the optic vesicle evaginates from the lateral walls of the diencephalon and forms the two-layered optic cup. The inner layer develops into the pigmented epithelium and the outer layer forms the sensory portion of the retina.

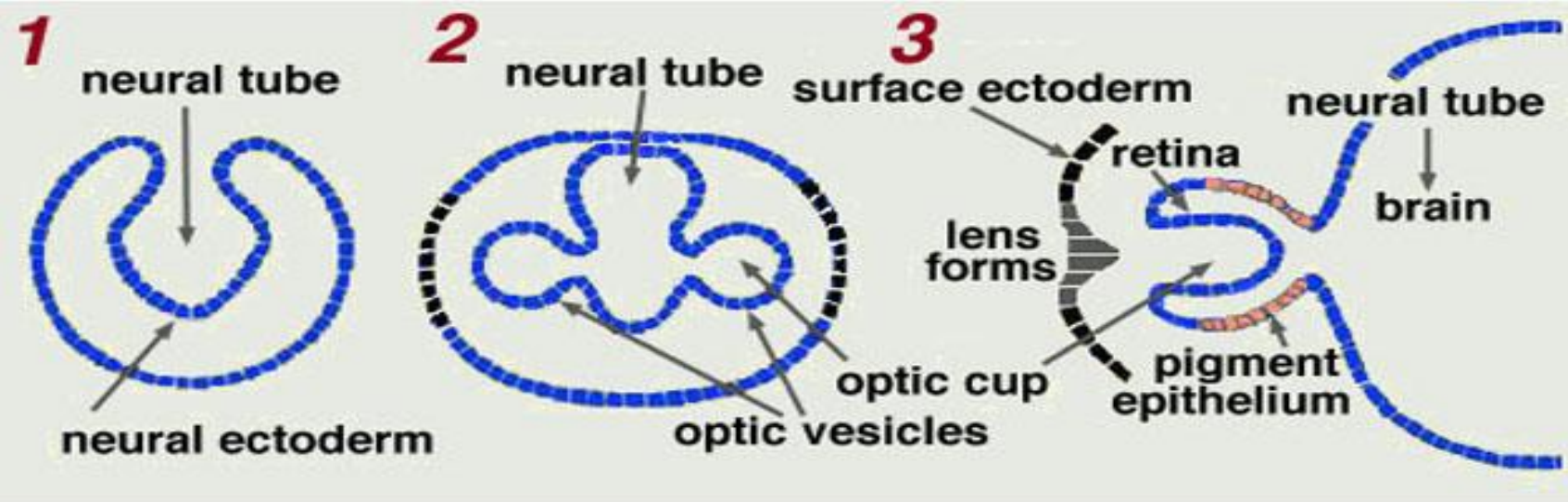


Fig. 4. Development of the eye from the neural tube though the optic vesicles and the inverted optic cup forming the retina.

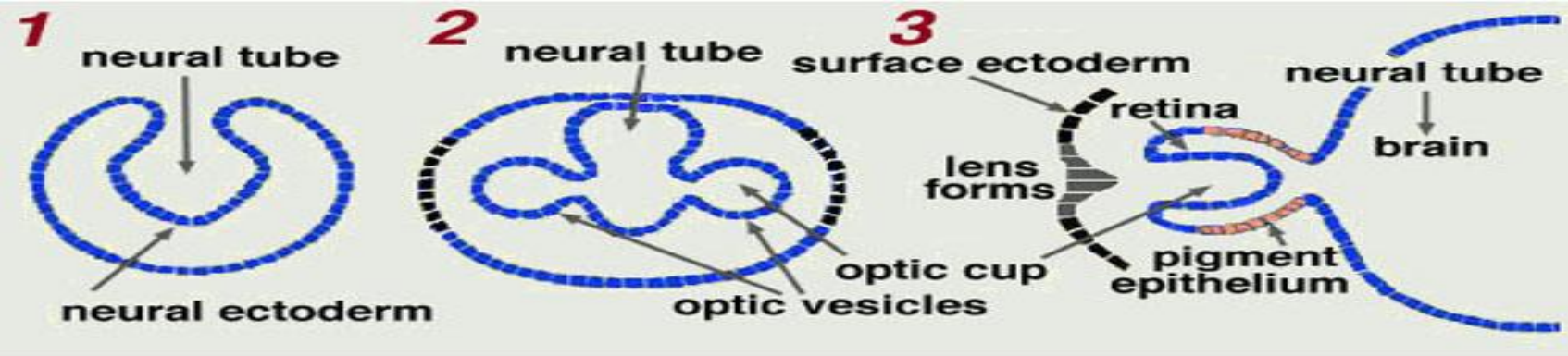


Fig. 4. Development of the eye from the neural tube though the optic vesicles and the inverted optic cup forming the retina.

The optic cup approaches the overlying ectoderm to induce formation of the lens vesicle.

The lens vesicle detaches inwardly from the surface and induces formation of the cornea from the ectoderm.

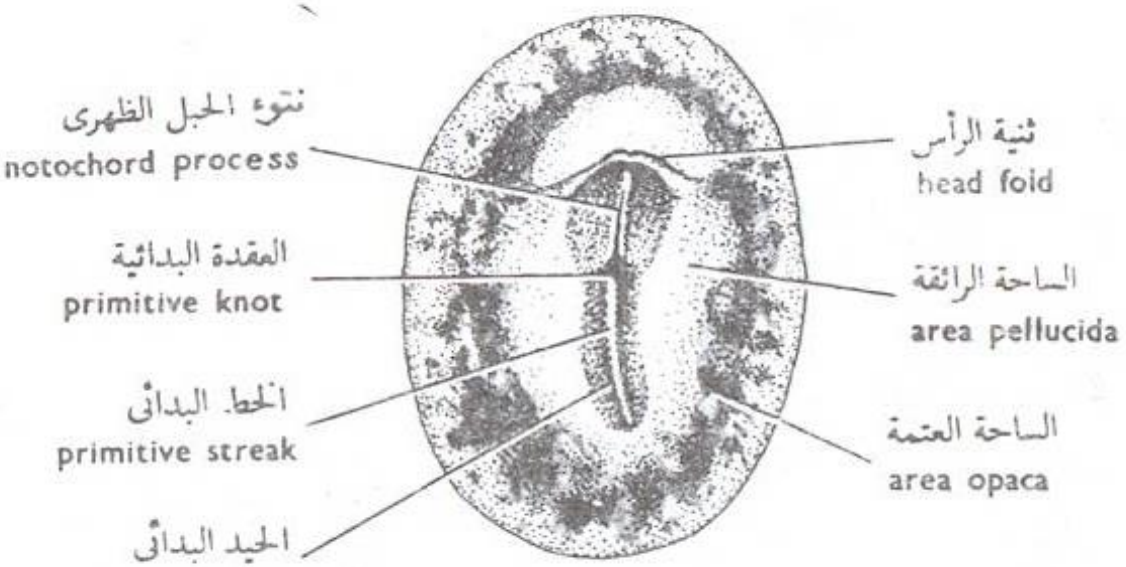
The iris and ciliary body differentiate from the optic cup.

Formation of mesoderm

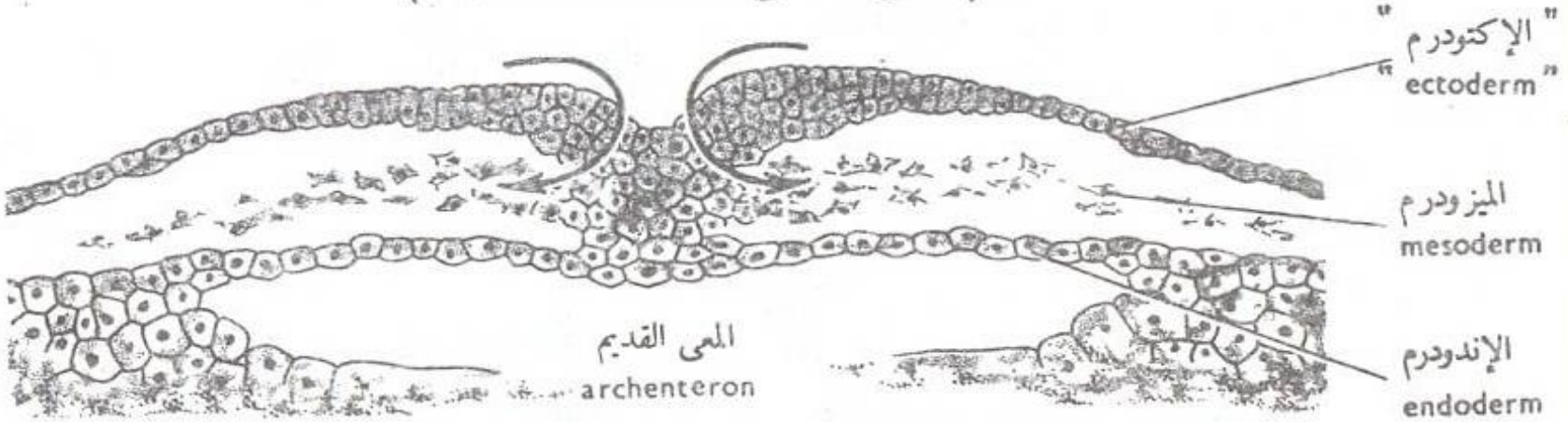
The mesoderm cells migrate as two sheets on either side of the primitive streak inside the blastocoel (inbetween the epiblast and hypoblast).

The mesodermal cells on arriving there pass inwards and then leave the sides of the streak and migrate laterally to form a sheet of cells on each side between the endoderm and the upper layer cells.

There is an inward migration of the mesodermal and notochord material so that the upper layer consists of ectoderm alone.



(منظر سطحى **Surface view**)



T.S. قطاع عرضى

(Formation of mesoderm تكوين الميزودرم)

- The mesoderm cells will not migrate anterior to the primitive streak. This mesoderm free area is called proamnion. This region is site for the development of the head.
- The cells of the primitive knot migrate in a forward direction only so as to form head process.

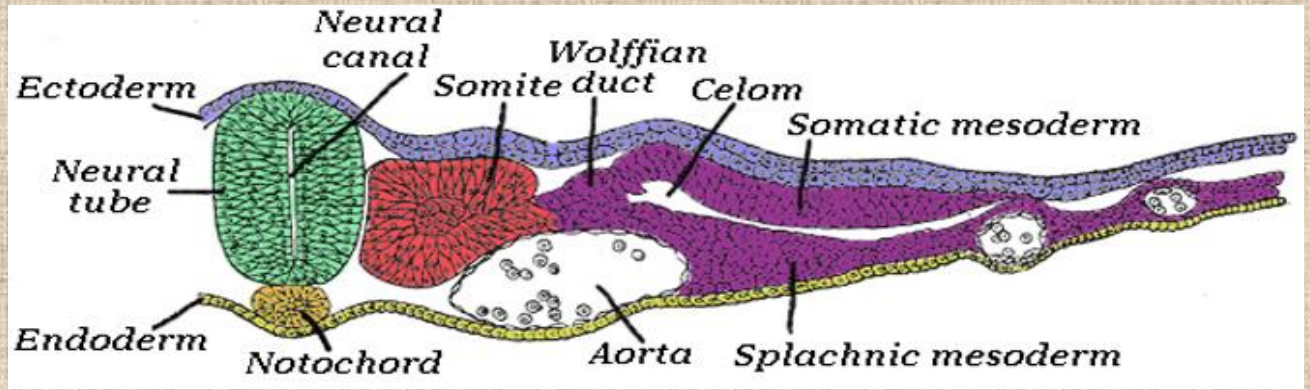
Somites Formation

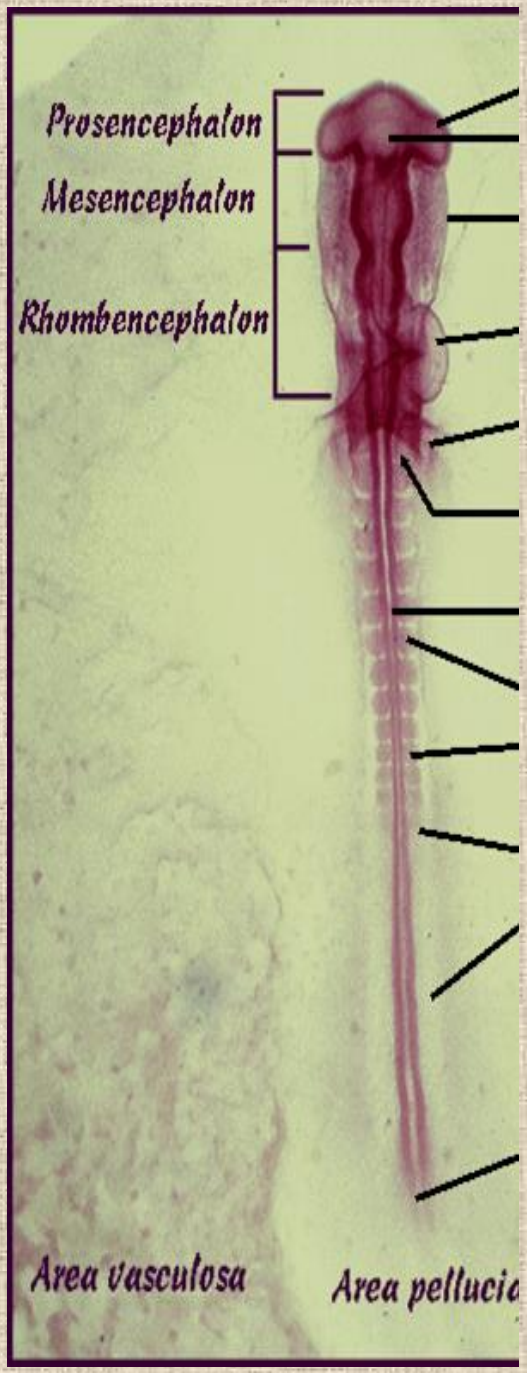
In the beginning, the mesoderm lies as solid sheet of loosely arranged cells, on either sides of notochord.

-A slit appears in it and enlarges to form the coelom.

but the cells close to notochord do not undergo splitting, it is then divided by vertical clefts into a series of cubical blocks on either side of the notochord. There are the mesodermal somites.

The first somite appears in the neck region at about 20 hrs. of incubation





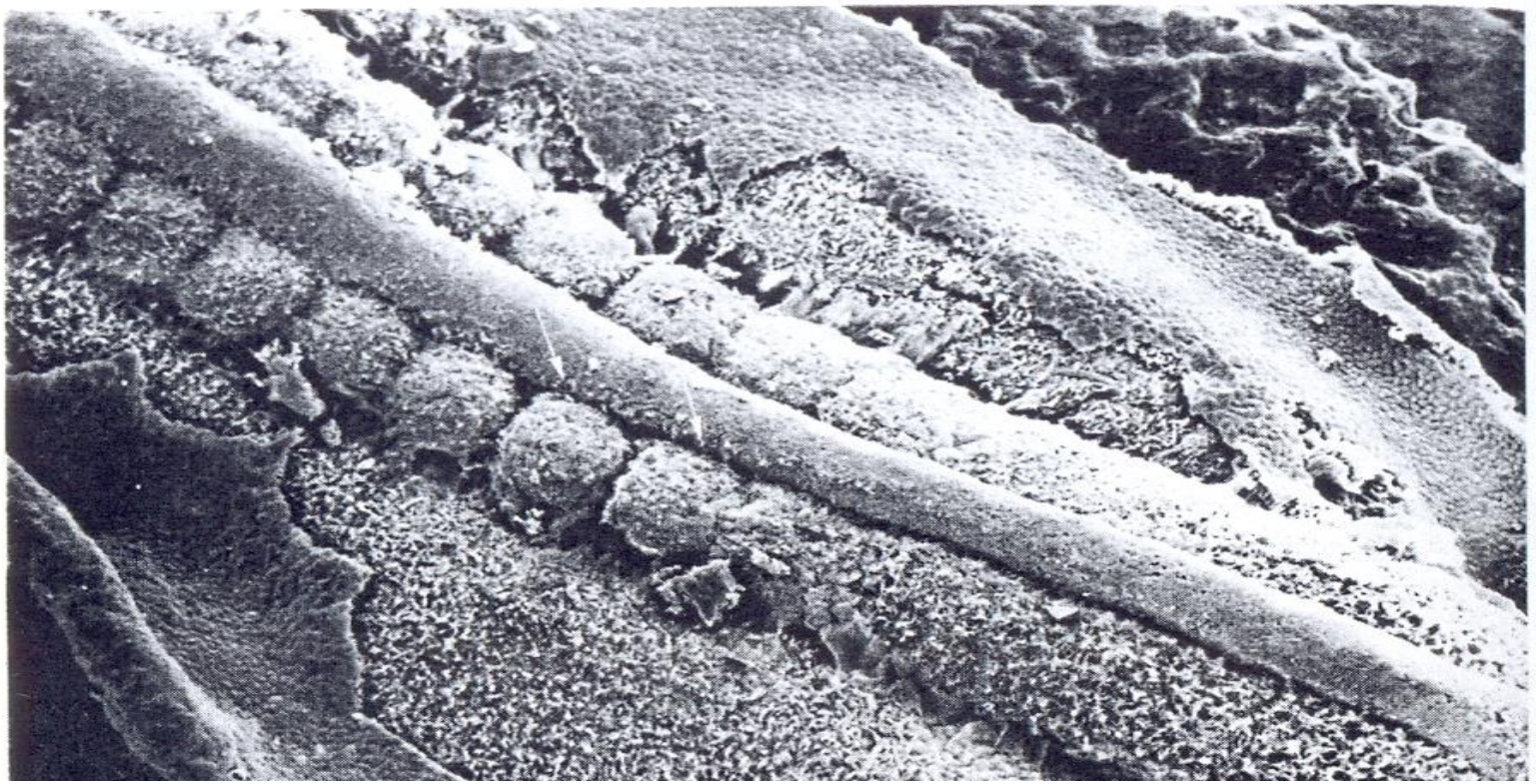
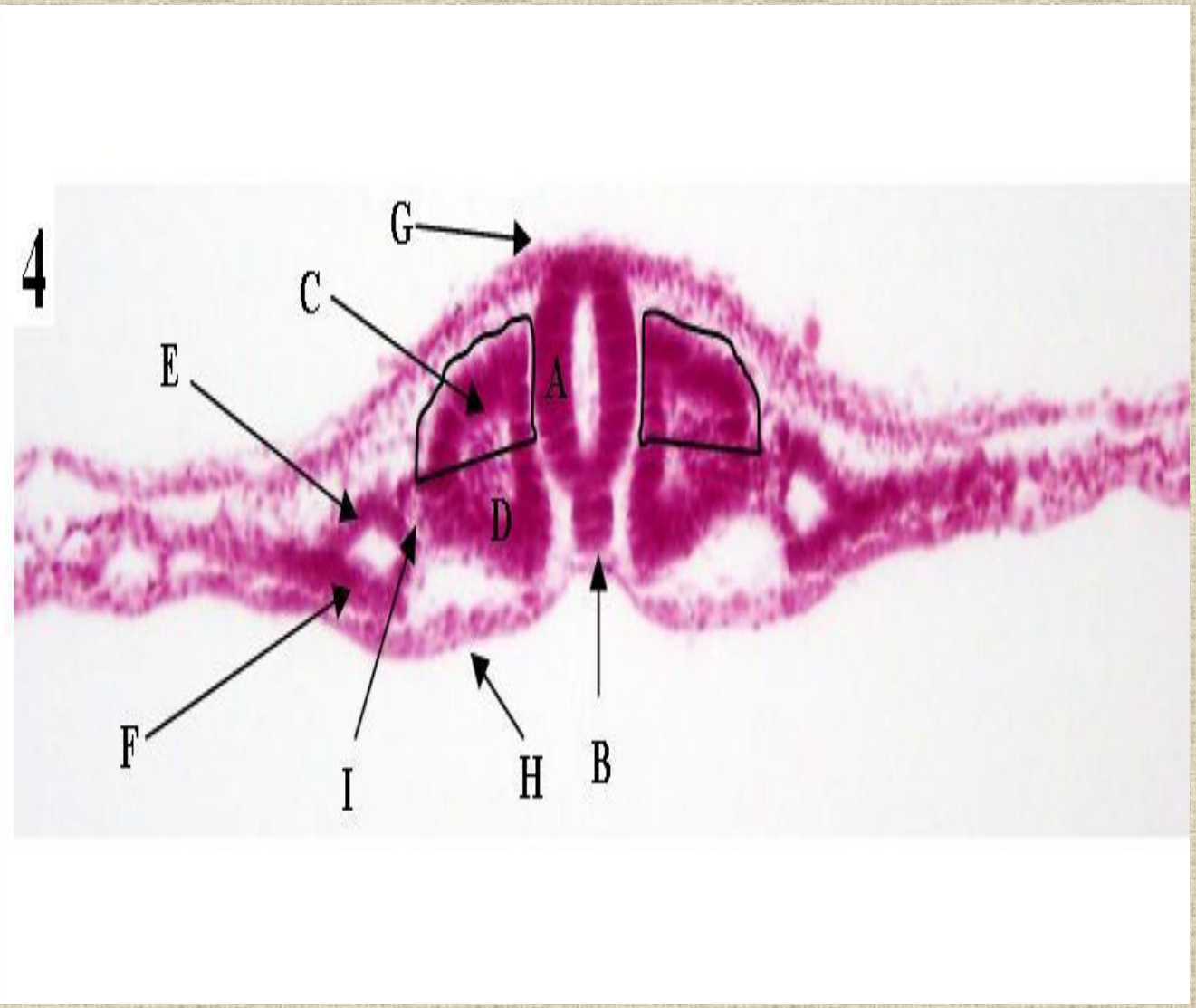


FIGURE 7-1
Scanning electron micrograph of the dorsal surface of a chick embryo after removal of the ectoderm. The upper left is cranial and the lower right is caudal. The long unsegmented structure is the neural tube and the segmented structures on either side of the neural tube to the left are somites. In the same line of tissue to the right of the somites is the unsegmented paraxial mesoderm. On the side of the neural tube just above the somites an irregular fringe of neural crest cells is beginning to move out from the neural tube (*arrows*). (*Courtesy of K. Tosney.*)

Fig. 4: Transverse section, 33 Hr. Chick

A: Neural Tube:
B: Notochord
C: Dermamyotome
D: Scleratome
E: Somatic Mesoderm
F: Splanchnic Mesoderm
G: Ectoderm
H: Endoderm
I: Intermediate Mesoderm

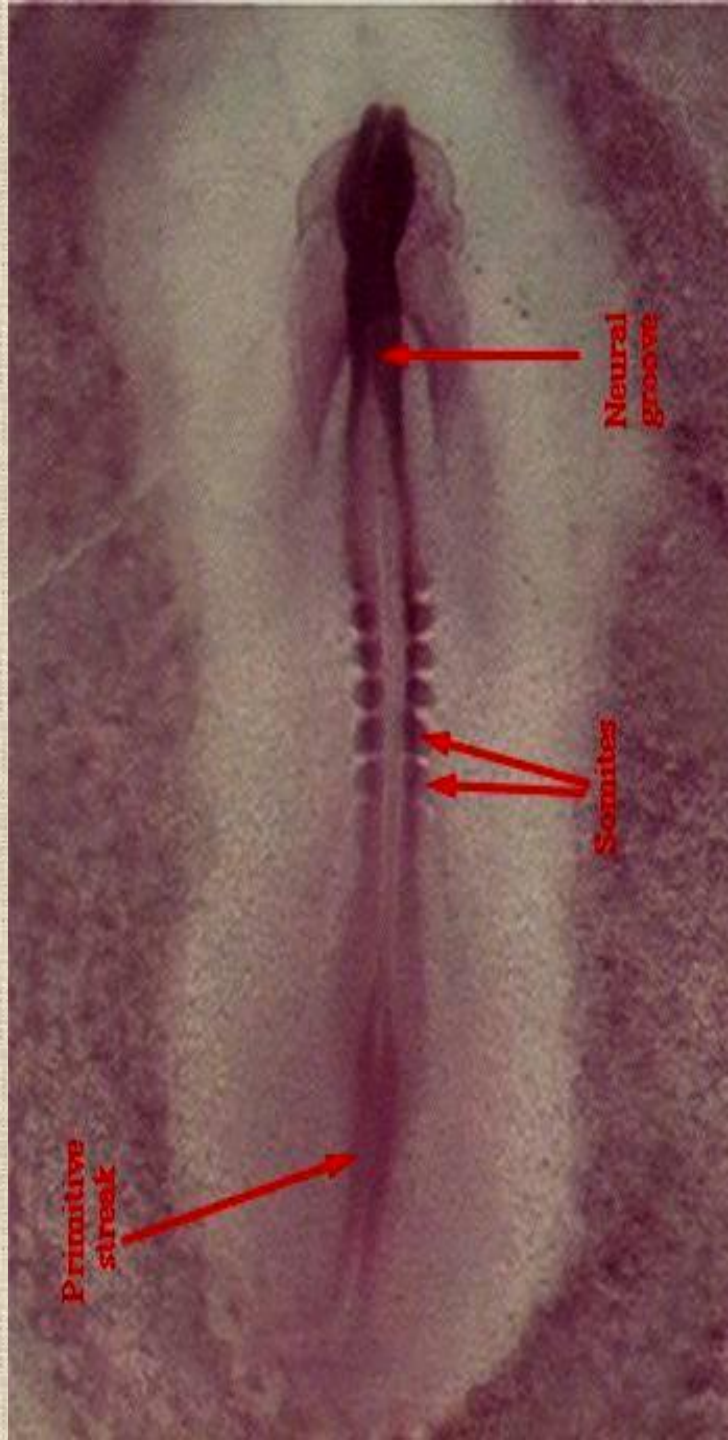


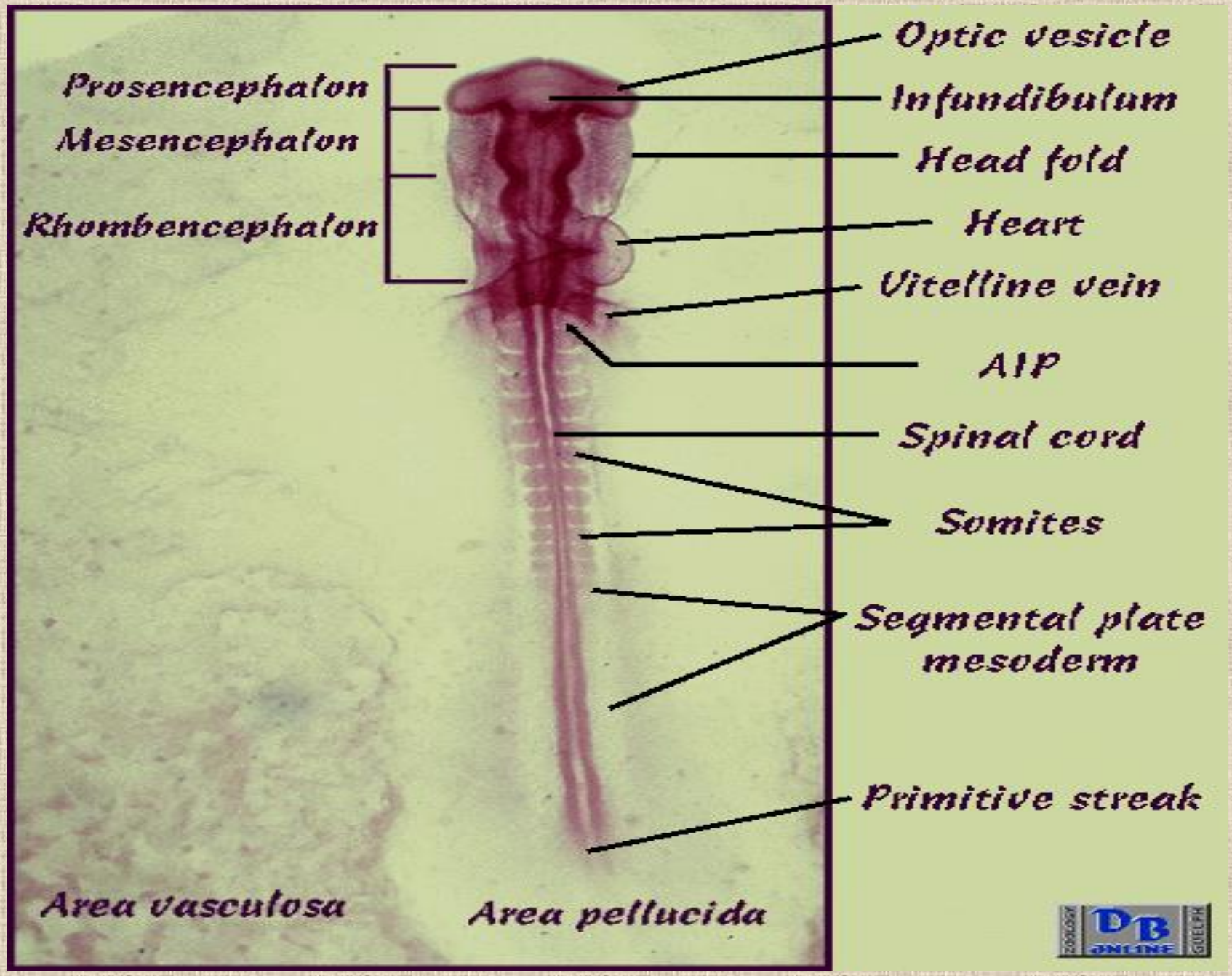
-The somites are not formed in the head region. They occur only in neck, tail and later on become differentiated into the myotomes, sclerotome and dermatome.

-Counts of the number of pairs of somites estimate hours of incubation.

-Hours incubation = 20 + pairs of somite.

After 50 hours the rate of somite formation slow down.




Prosencephalon
Mesencephalon
Rhombencephalon
Optic vesicle
Infundibulum
Head fold
Heart
Vitelline vein
AIP
Spinal cord
Somites
Segmental plate mesoderm
Primitive streak
Area vasculosa
Area pellucida

Coelom

- The coelom develops by the splitting of mesodermal cells,

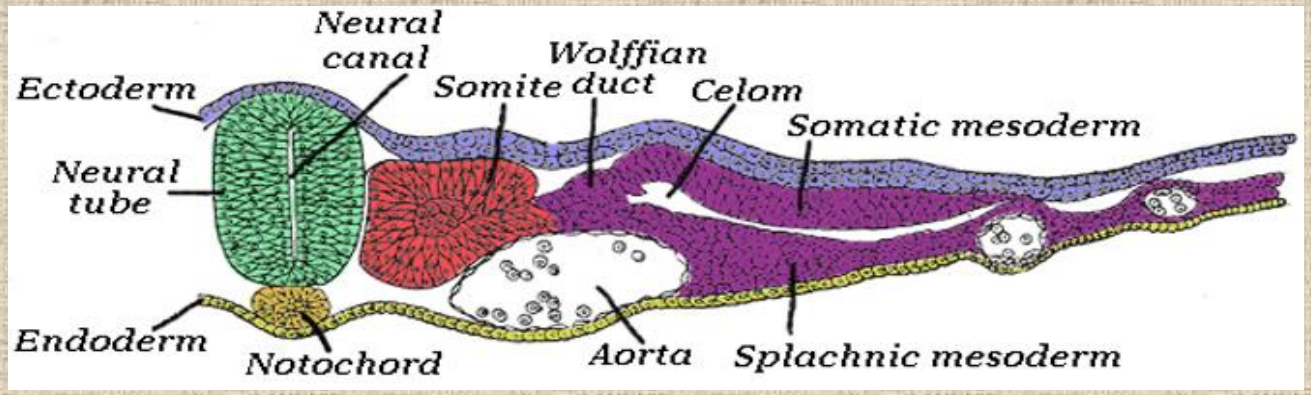
-This space has an upper layer and a lower layer of cells,

The upper layer which is next to the ectoderm is the somatic layer.

The lower layer which is next to the endoderm is the splanchnic layer.

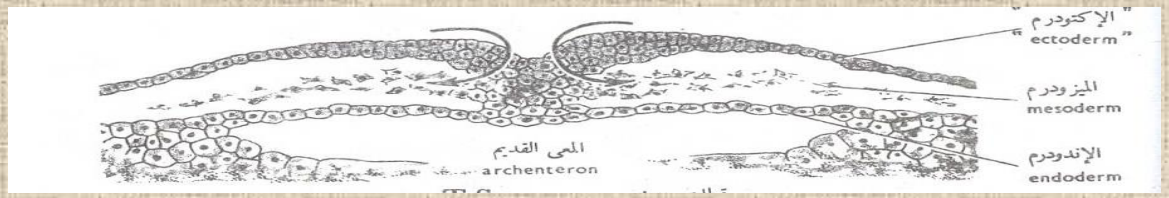
-The ectoderm+somatic mesoderm is somatopleure

-endoderm + splanchnic mesoderm is splanchnopleure.



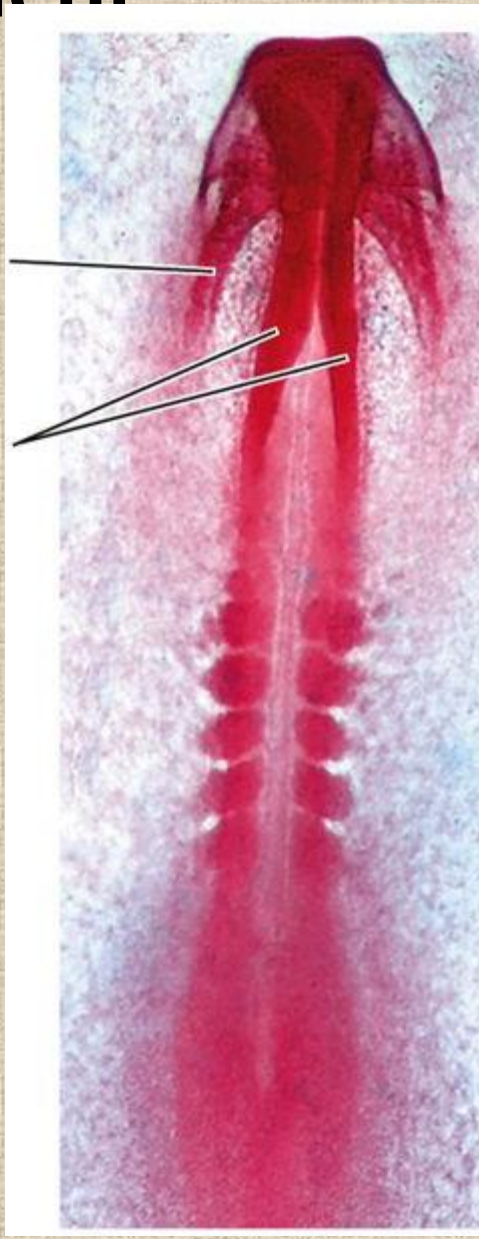
Alimentary canal development

The gut first makes it appearance as archenteron which has endodermal layer dorsally and yolk ventrally.



The fore gut appears at the head end of the embryo on 1st day of incubation as a blind pocket of splanchnopleure. This at first opens at its side, and posteriorly on the yolk by the opening called anterior intestinal portal.

Fore gut gradually increase in size.



The hind gut appears as a cavity after 40 hrs. of incubation.

The cavity open anteriorly (future mid gut) through the posterior intestinal portal. At the end of hind gut, the endoderm fuse with the ectoderm forming a thick anal plate which becomes anus.

The mid gut appears in the second day of incubation overlying the yolk. It becomes well defined by the end of 3rd day.

The pharynx becomes differentiated after 32 hrs. of incubation. The endoderm binding the anterior end soon fuses with the ectoderm ventrally to form the oral plate. On this mouth appears when the embryo is 60hrs. old.

At four places along each side, the pharyngeal wall pushes out laterally as pharyngeal pouches

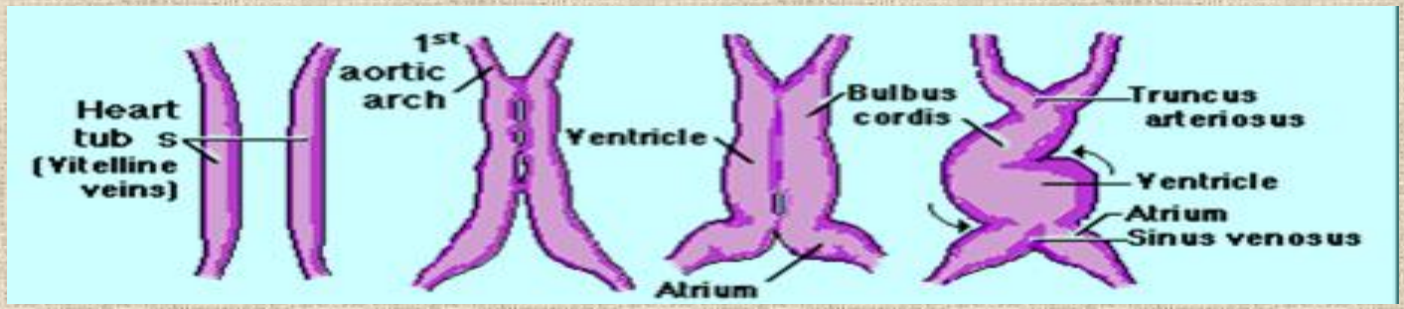
Finally fuse with the ectoderm. At the fusion of the first three pouches, perforations occur giving to visceral clefts but the fourth pouches however opens outside. The visceral arches appear during the second day.

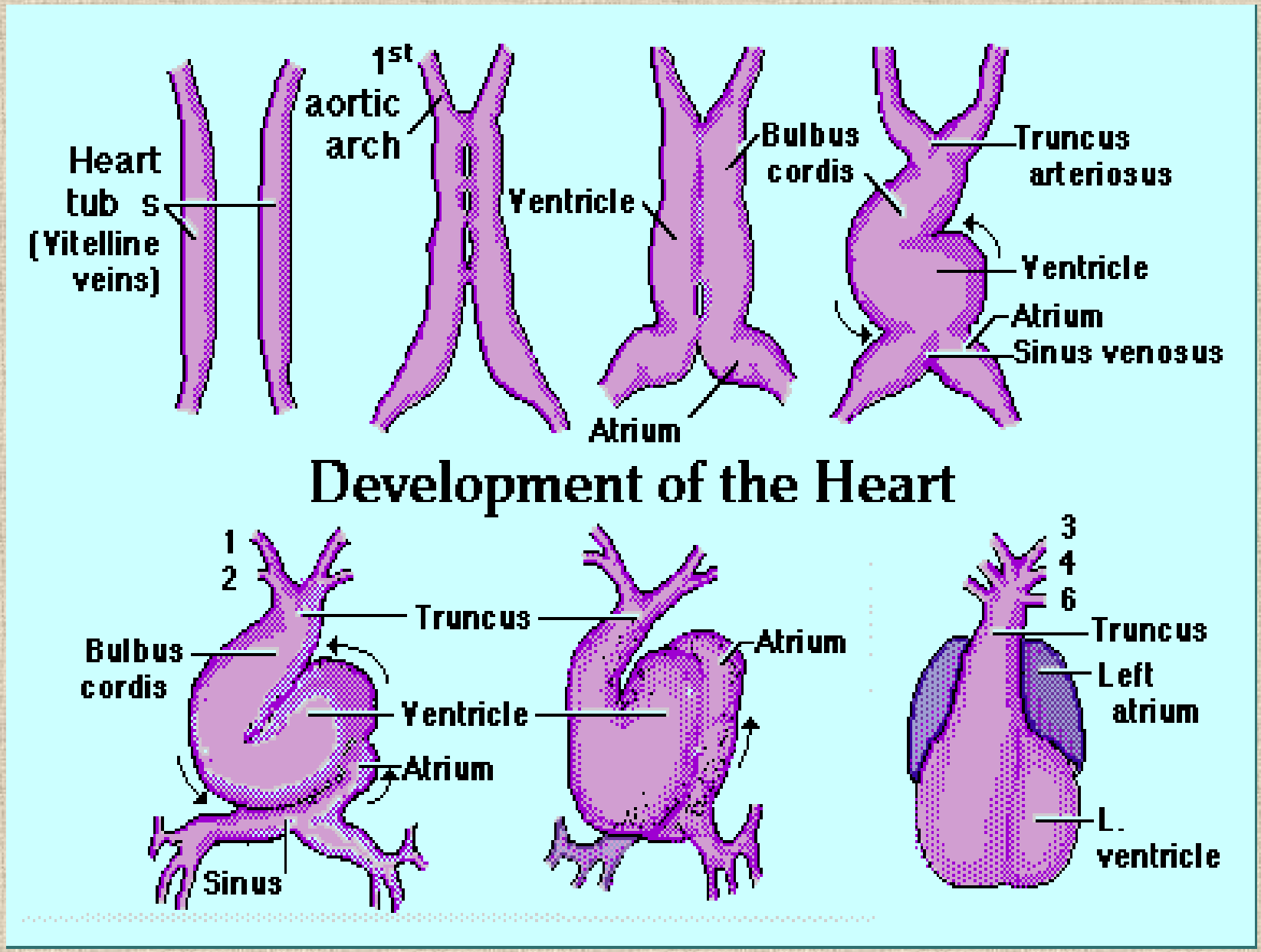
Development of heart

The rudiments of circulatory system appear even before any somites formed in the form of blood islands in the area opaca (area vasculosa) and the area surrounding it the area vitellina.

The heart develops from the fusion of paired precardiac mesodermal tubes located on either side of the developing foregut, on the ventral surface.

Between 25 and 30 hours of incubation, the paired heart vesicles fuse form one continuous tube

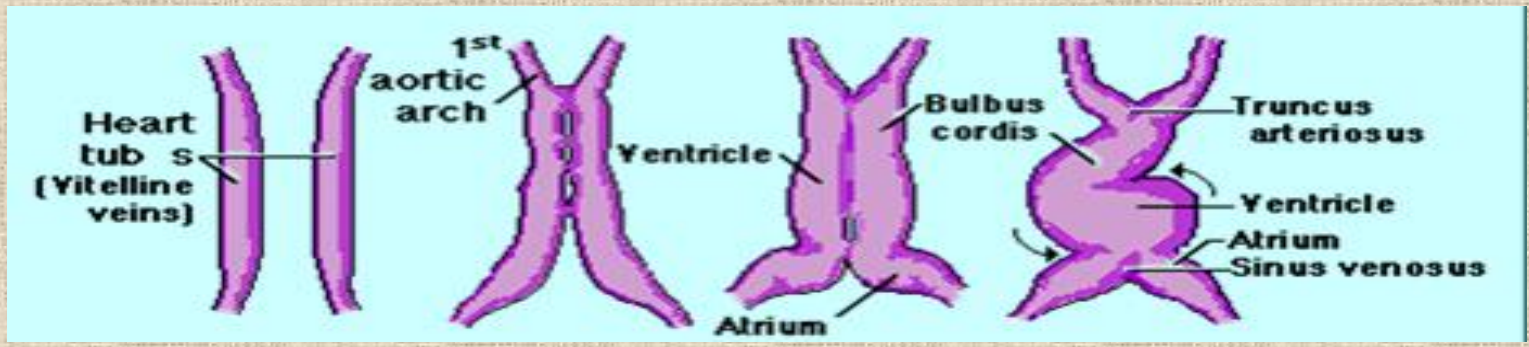



Heart tub s (Yitelline veins)
1st aortic arch
Ventricle
Bulbus cordis
Truncus arteriosus
Ventricle
Atrium
Sinus venosus
Atrium
Development of the Heart
1
2
Truncus
Bulbus cordis
Ventricle
Atrium
Sinus
Atrium
3
4
6
Truncus
Left atrium
L. ventricle

The heart tube has four regions that can be identified from anterior to posterior: truncus arteriosus, ventricle, atrium, and sinus venosus.

At approximately 33 hours the heart tube bends to form an "S" shape, with the prominent ventricle bulging to the right.

By 48 hours, the heart has folded upon itself, forming a single loop. This moves the sinus venosus and atrium to a position anterior and dorsal to the ventricle and the truncus arteriosus.



The ventricle is U-shaped and in the medial ventral position.

In the 72-hour embryo, the atrium expand into the right and left atria.

The sinus venosus becoming part of the future right atrium. The truncus arteriosus give rise to the aorta.

Eventually, when the atrium and ventricle each divide into a pair of chambers, and a typical four-chambered heart is present and enclosed in the pericardial cavity.