Development of Chick Embryo (Part II) (Contd.)

B.Sc Part II Paper IV A

V Disappearance of Primitive Streak → Elongation of the primitive streak stops when no more epiblast cells are available to replenish the streak area. The streak then begins to shrink. The anterior end with Hensen's node recedes posteriorly. The streak ultimately becomes reduced to a fragment in the tail end and becomes area or clear of the embryo.

VI Development of Head process — Gastrulation is completed at about 20 to 25 hours of incubation at which point the blastoderm is in the so-called head process stage. The middle area of notochordal tissue has developed, in the form a rigid rod, anterior to the primitive streak. As the streak regresses posteriorly, the embryo develops anterior to it. The thicken central portion alone provides the definitive notochord, whereas the lateral wings contribute to the somatic mesoderm that come to flank the notochord.

VII Completion of Endoderm → The first cells that move into the interior through the anterior part of streak from the endoderm

As the Hensen's node shifts backward and the notochordal process elongates in its wake, the precumptive endoderm of the middle and posterior part of the gut, located just behind the node move inside as an endodermal strip underneath the notochord. The endoderm has dual origin. In chick embryo, an archenteron is formed during the process of gastrulation. The endoderm formation rapidly outstrip that of the mesoderm, so that an endodermal layer is complete when the mesoderm is still only partly invaginated. The premature formation of the endoderm determines the orientation of the primitive streak. (Bersill & Karp, 1976)

VIII Structure of fully formed gastrula -

The stage of disappearance of the definitive primitive streak may be marks the end of gastrulation and beginning of the neurulation. The fully formed chick gastrula consists of three germ layer - ectoderm, chorda-mesoderm and endoderm. The ectoderm and chorda-mesoderm remain in contact along the axis of the primitive streak, just as they are at the lateral lips of an amphibian blastopore. The endoderm is also united with the

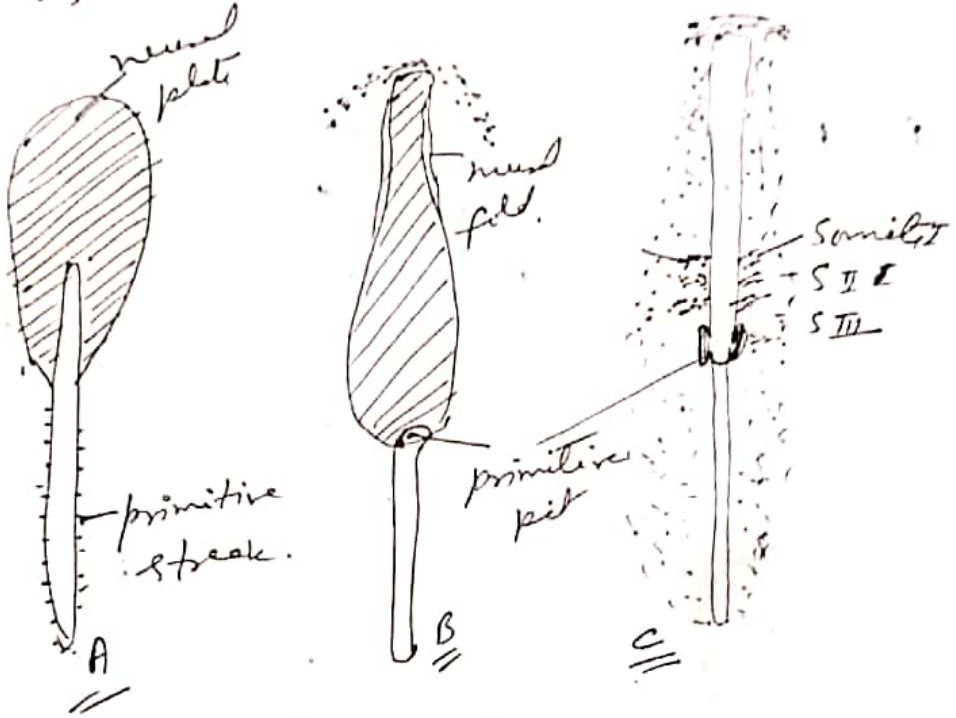
mesoderm and ectoderm of the anterior end of the streak and at its posterior end.

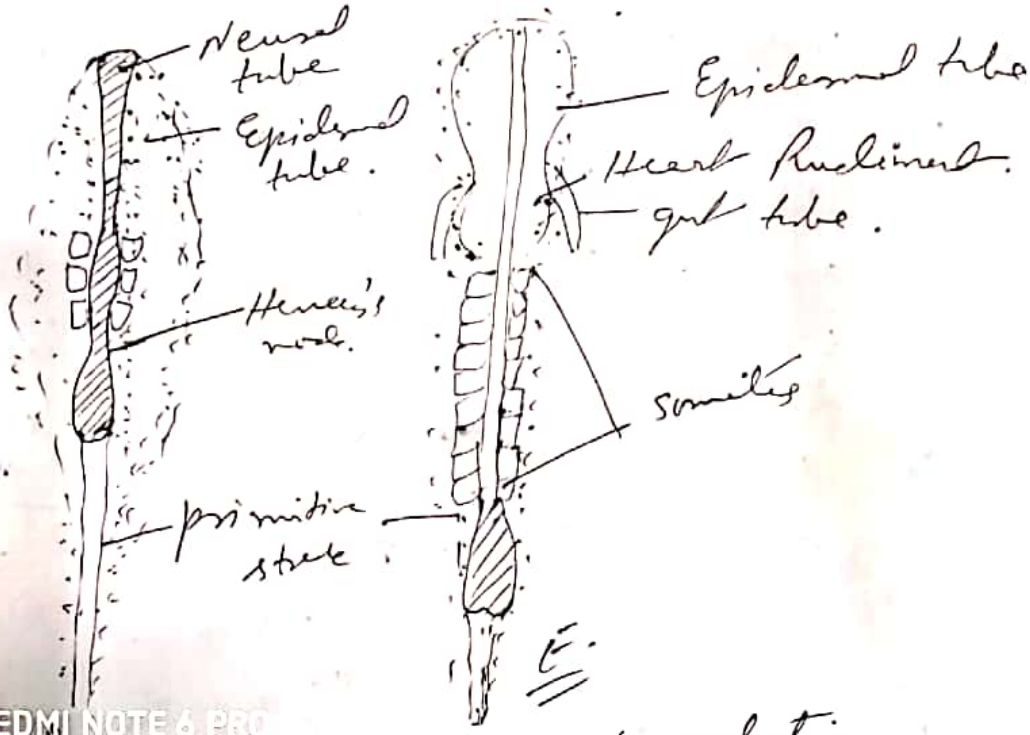
IX Neurulation and Tubulation — The neurulation and tubulation process of chick include the same events as in amphibians and during it following process occur — (i) The ectoderm differentiate into neural plate and epidermis (ii) Neural plate is converted into neural tube. (iii) The chorda-mesoderm divides into noto-chord and mesoderm. The latter further differentiate into its different subkinds. (iv) The endoderm develops into primitive gut.

The neural tube formation proceeds in an antero-posterior direction. The neural plate appears in the brain region; while the gastulation movements are still in full swing. The parts of neural tube become differentiated and the anterior part of the neural plate proceed to close into a tube, the neural tube. While the neural plate is folding into the neural tube, the chorda-mesoderm is also differentiating. Its most anterior part, the prechordal mesoderm gives rise to most of the mesenchyme of the head. Behind it lies the notochord. The notochordal cells are separated from rest of the developing cells of mesoderm and differentiate into notochord.

(V) <u>Formation of Somites</u> → Appearance of segmentally arranged somites in the embryonic mesoderm is most important event. A sheet of loosely bound cells condenses into a series of compact blocks of tissue on either side of the developing neural tube and notochord. This is the first sign of segmentation. These somite cells elongate after attaching to the basal lamina, while the more flattened, unattached meso-blast cells below continue to migrate. More cells accumulate in the future somite area, possibly by virtue of their greater adhesive tendencies. Non-somite cells beneath the presump-tive epidermis show few signs of condensation or packing, which suggests that the neural plate cells influence the behaviour of somite cells below. As the neural tube begins to roll up, the adherent somite cells remain for a while but soon detach from the basal lamina and a space, probably filled with matrix materials, appears between the somite and tube. The first three pairs of somites are formed in the paraxial mesoderm beneath a broad region of the neural plate in presumptive hind brain region. and ... parts of somites are

demarcated by intersomitic clefts as the node regresses, forming a series of cuboidal blocks, becoming triangular in cross section as they conform to their situation adjacent to the notochord and the neural tube on their inner face and to the overlying ectoderm to the outside.





Different stages of Neurulation in chick Embryo

Development of chick Embryo according to hours of Incubation:—

Actually the egg of chick embryo is designated in terms of hours of incubation and in terms of number of somites.

A// chick embryo during 24 hours of Incubation — it has developed following characters —

(i) Primitive streak is formed and gastrulation is completed within 20 hours of Incubation.

(ii) In the area opaca, the mesoderm cells are aggregated in small clusters called blood islands which originate erythrocytes.

(iii) The primitive groove system first arose as a flat-plate then to form neural folds and neural groove.

(iv) At about 20 hours of incubation, the thickened anterior part of the embryonic area is elevated above the level of surrounding blastoderm. This is head fold, the anterior border of future head.

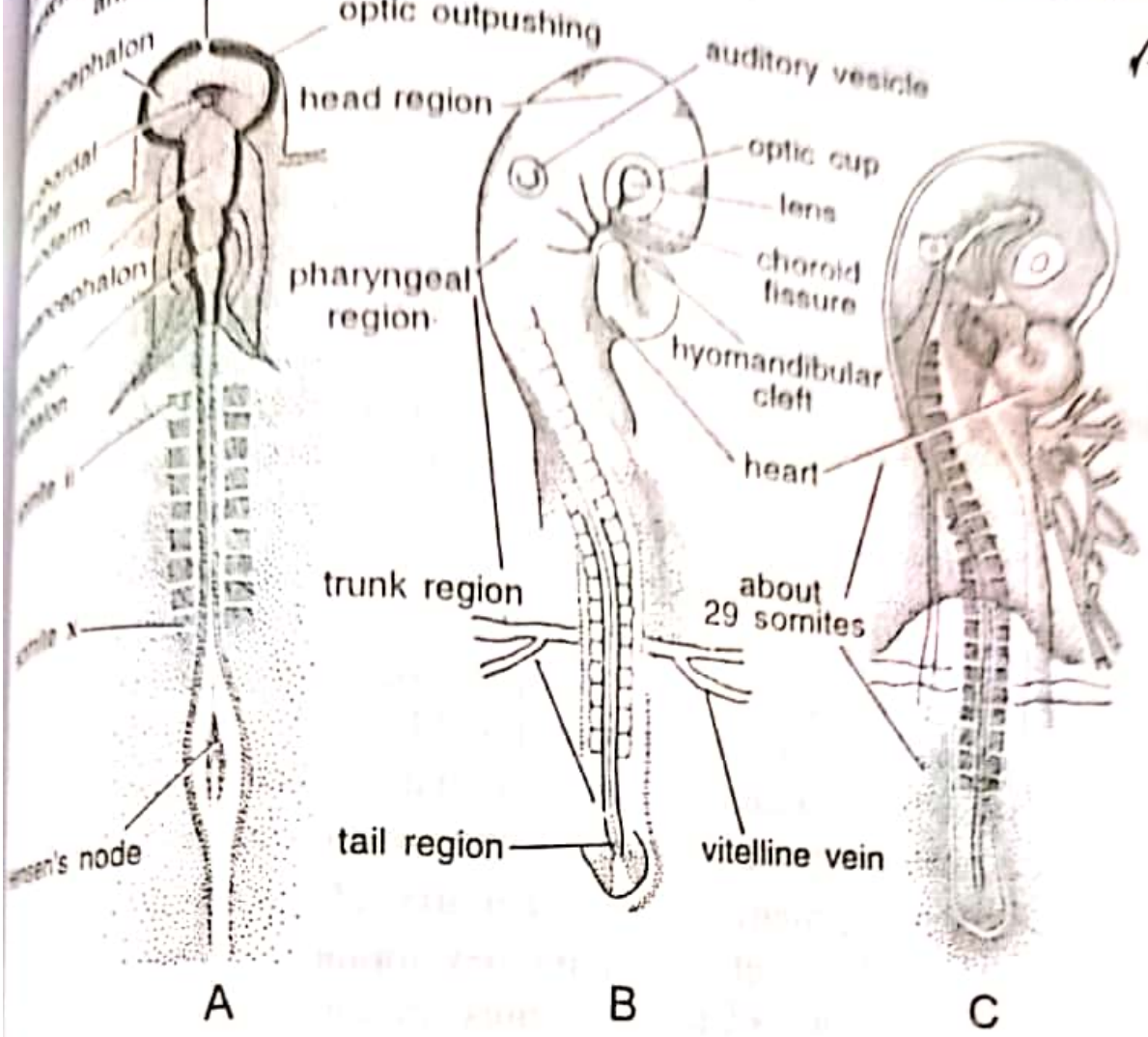
(v) Seven pairs of mesodermal somites are formed and the notochord forms a rod extending from the head region to the primitive streak.

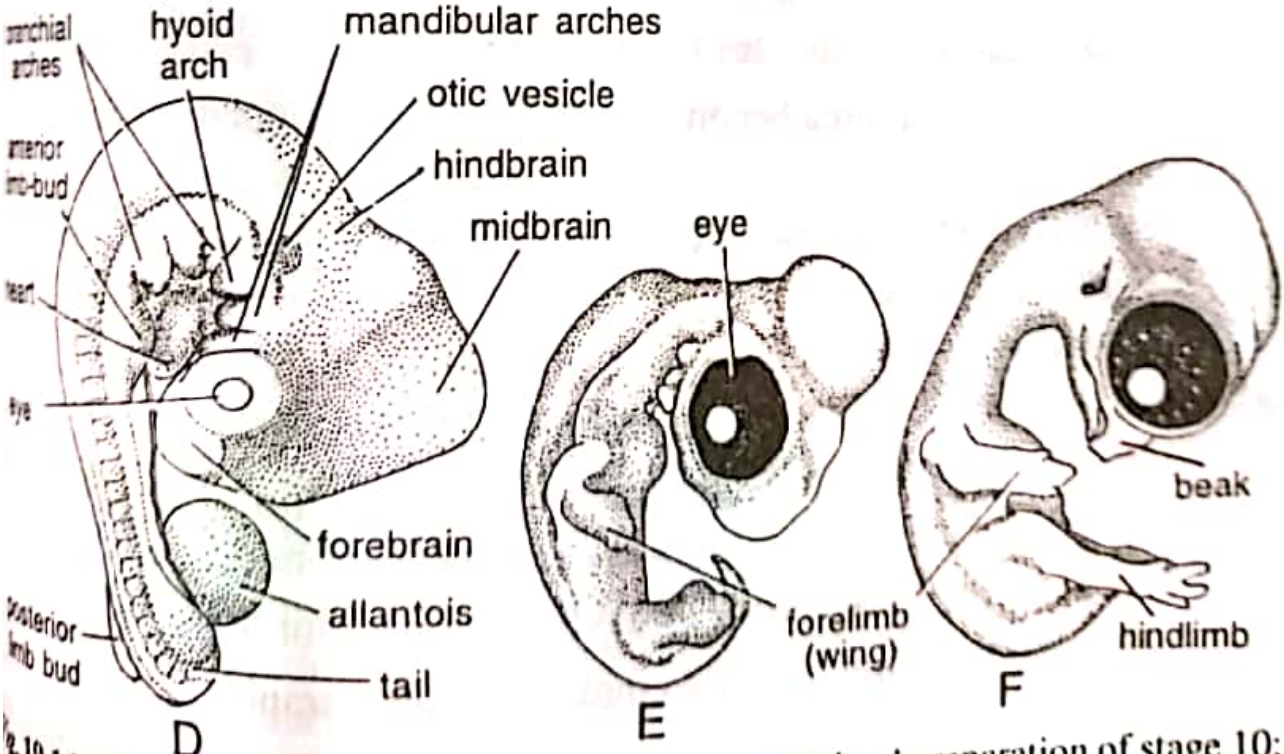
... during 48 hours of

(ii) The neural tube get differentiated into prosencephalon with optic vesicles, mesencephalon and rhombencephalon.
(iii) The auditory placode becomes visible in ectoderm adjacent to the rhombencephalon.
(iv) A tubular heart is formed and starts to contract. Large vitelline arteries also extend from heart to area vasculosa.
(v) Formation of extra-embryonic membranes started.
(vi) At the end of 48 hours, 27 pairs of somites are visible.

c) Chick Embryo during 72 hours of incubation — further development is characterised by a progressive differentiation of the structures present at the 48 hours stage. During this period-
(i) The no. of somites became 36 pairs.
(ii) The vascular area becomes extensively developed and cover the yolk.
(iii) The amnion completely covers the embryo and a small allantois has grown out from the hindgut.
(iv) The paired cerebral hemispheres begin to bulge from the roof of the telencephalon. other parts of brain become well-marked.
(v) The eyes develop completely. The auditory vesicles become pear shaped and the enlarged cleft becomes middle ear. The hind limb bud appears.

anterior neuropore





19.14. Post-neurular development of chick. A—Stained preparation of stage 10; B—External view of embryo of about 27–28 pairs of somites (51 to 56 hours of incubation, stage 16); C—Internal anatomy of stage 16 (of B); D—Embryo of about 72 to 75 hours of incubation (stage 20); E—Embryo of stage 23; F—Embryo of stage 27 (after Nelsen, 1953 and Balinsky,