27 STUDIES ON CHICK EMBRYO USING PREPARED SLIDES

27.1 INTRODUCTION

In exercise 26 we have described the procedure for making the whole mounts of early blastoderm of chick employs upto 48 hrs of age. Beyond 48 hrs the thickness of embryo increases and it may not be easy for you to prepare the whole mounts. However prepared permanent slides of the whole mounts and sections of embryos can be used for the study of chick embryology. In this exercise you will observe under the microscope the developmental stages of chick embryo starting from the differentiation of blastodisc stage and follow the development of organs and organ systems. Make careful observations of the slides showing different stages of development of chick embryos. Match your observations with a descriptions we have provided here for each of the stages and draw neat and labelled diagrams in your record note book. The study of embryology of chick would enable you to understand the differentiation of tissues, organs and organ systems from early embryonic cells. Again such a study is possible only upto a certain stage of development, say 96 to 120 hours.

Objectives

After completing this exercise you will be able to:

- identify the various stages in development of chick embryos,
- illustrate through the diagrams the various stages of the developing embryo,
- trace the progressive development of organ and organ system of the chick embryo.

27.2 MATERIALS REQUIRED

dissecting microscope

compound microscope

prepared sides of whole mounts and sections of different stages of chick embroys

27.3 OBSERVATIONS

A CHICK EMBRYO—4 HOURS (WHOLE MOUNT)

In this slide you will observe the differentiation of the blastodisc into area pellucida and area opaca. You may also note that one quadrant of **area pellucida** is thickened. This marks the future caudal end of embryo. (Fig. 27.1). After 7 to 8 hours, the thickening becomes more elongated and represents the start of **primitive streak**. Draw the diagram and label it.

B CHICK EMBRYO—16 HOURS (W.M.)

In a 16 hour embryo (Fig. 27.2) you will observe the distinct primitive streak. The embryo at this stages is characterized as being in **primitive streak stage**. In a fixed and stained slide the embryo is composed of central furrow, called as **primitive groove** lined by thickened **primitive ridges**. At the cephalic end (head end) of the embryo, closely packed cells form thickened area, called as **Hensen's node**. Part of area pellucida adjacent to the primitive streak shows increased thickness and forms embryonic area or embryonic shield. Note that area pellucida assumes elliptical shape. Elongated primitive streak represents long axis of future embryonic body. The end diametrically opposite to the Hensen's node is the caudal end of the embryo.

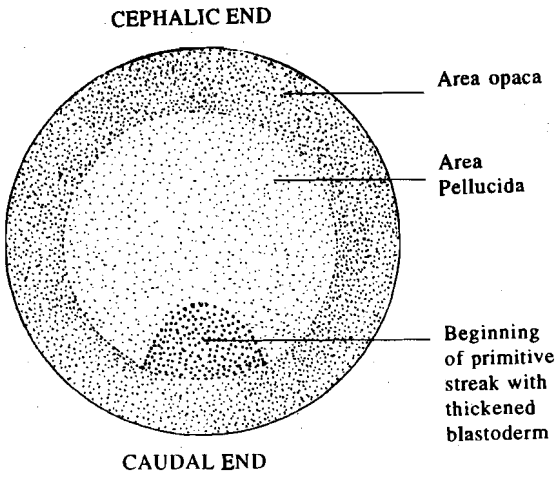

Fig. 27.1 : Chick embryo, 4 hours after incubation (W.M.).

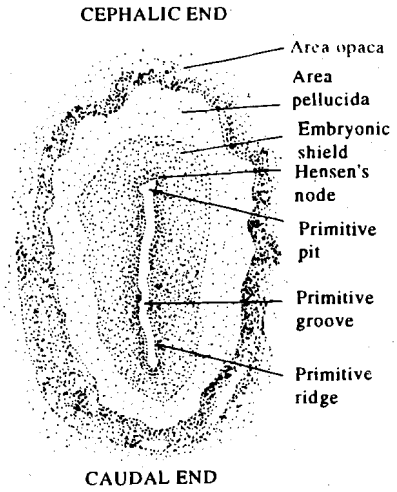

Fig. 27.2 : Whole mount of chick embryo, 16 hours after incubation.

C L.S. OF 16 HOURS EMBRYO

Longitudinal section through 16 hours embryo represents the stage shortly after primitive streak formation and it also marks the beginning of morphogenetic movement of cells to form notochord. The section shows ectoderm, Hensen's node, primitive pit, primitive groove, notochord and primitive gut. The mesoderm extends on either side between ectoderm and endoderm (Fig. 27.3).

Morphogenesis is a Greek word meaning formation of structure or form, Morphos : structure or form, genesis : origin.

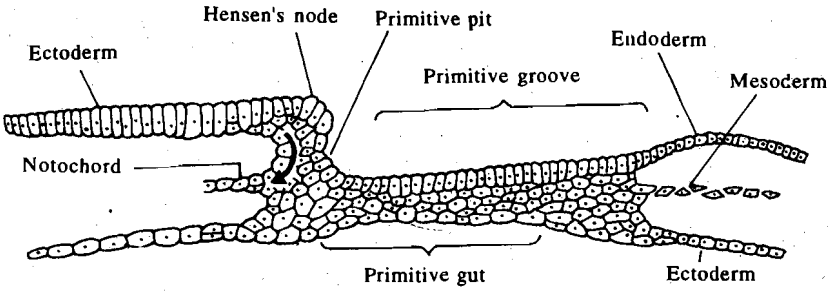

Fig. 27.3 : Chick-embryo, L.S. of 16 hours old embryo.

D CHICK EMBRYO—18 HOURS (W.M)

In the 18 hour embryo you will observe that the notochord has become markedly elongated to form a conspicuous structure. Notochord extends towards the cephalic region in the middle from Hensen's node. Embryo of this period of incubation is spoken of being in the **head process stage. Neural plate** develops around the notochord. The dark peripheral area opaca, inner translucent **area pellucida** and central **embryonal area** are clearly seen. In the anterior region you will observe a small and more translucent portion of area pellucida, known as **proamnion.** Primitive streak lies in the middle of the area pellucida in the posterior half. You will observe that neural plate and primitive streak are separated by Hensen's node.

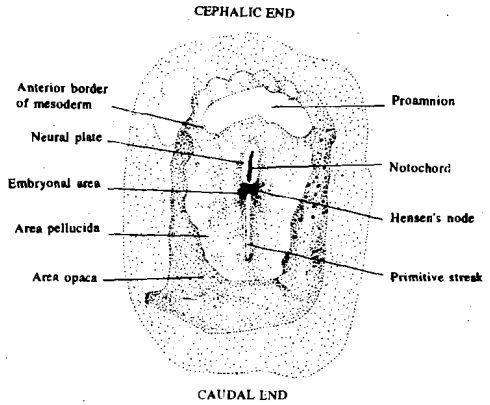

Fig. 27.4 : Whole mount of chick embryo, 18 hours after incubation.

E L.S. OF 18 HOURS EMBRYO

Longitudinal section of 18 hours incubated embryo shows advanced inner structure of the germ layers. Ectoderm has vertical cells while the cells of mesoderm are represented by heavy angular dots. Endoderm is represented by stippling backed by a single line. You will observe in the slide (Fig. 27.5 A) yolk, ectoderm of neural plate, notochord, mesoderm, ectoderm and endoderm of blastoderm. You may also observe (Fig. 27.5 B) yolk, endoderm, primitive pit, primitive ridge, mesoderm and primitive gut.

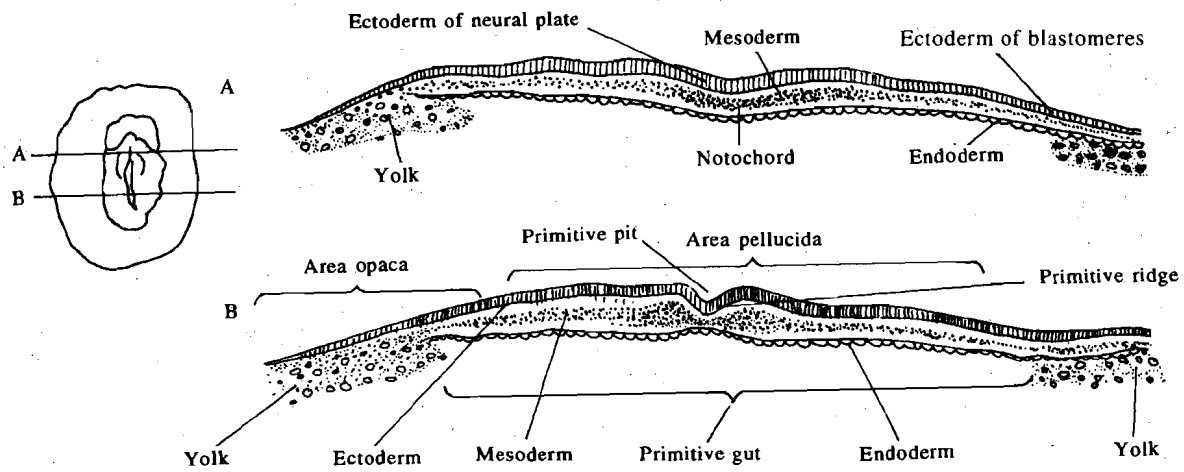

Fig. 27.5 : L.S. of chick embryo 18 hours after incubation.

F CHICK EMBRYO 24 HOURS (W.M.)

In a 24 hour old embryo the cephalic region is seen prominent because of rapid growth in this region. It extends anteriorly overhanging the proamnion region. The cephalic region which projects free from the blastoderm may now properly be termed as the head of embryo. The space formed between the head and the blastoderm is called the sub-cephalic pocket. In the mid-line the notochord is seen. It is larger caudally near its point of origin than it is cephalically. The neural plate is much more clearly marked. The neural folds appear as a pair of dark bands. At its cephalic end, the neural groove is

deeper and the neural folds are correspondingly more prominent than they are caudally. Four pairs of somites are seen in the mid-line. Primitive streak gradually decreases in size. Foregut is also formed. The part of the gut caudal to the foregut is termed the midgut and the opening from the midgut into the foregut is called the anterior intestinal portal. Besides these structures, **area opaca vitellina, area pellucida, proamnion. Hensen's node, area vasculosa, blood islands and unsegmented mesoderm** are also seen (Fig. 27.6).

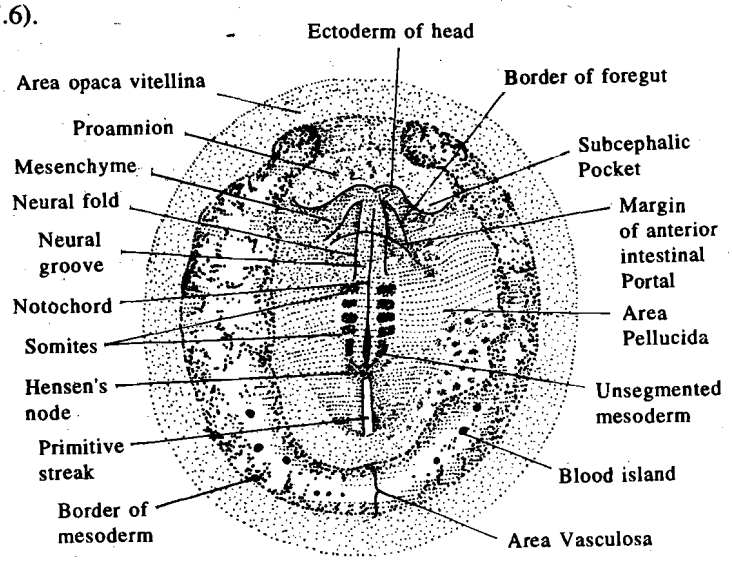

Fig. 27.6 : Chick embryo, 24 hours (W.M.)

G T.S. OF 24 HOURS EMBRYO

Transverse section passing through head region (Fig. 27.7A) shows neural plate folded to form a complete tube. Beneath neural fold is notochord. Other structures seen in the section are mesenchyme, foregut, ectoderm of head, mesoderm and endoderm. The transverse section passing through mid body of chick embryo (Fig. 27.7B) shows formation of somites and changes in mesoderm. Mesoderm is differentiated into dorsal mesoderm, intermediate mesoderm and lateral mesoderm. Other structures seen are ectoderm, endoderm, lateral margin of anterior intestinal portal midgut and pericardial coelom.

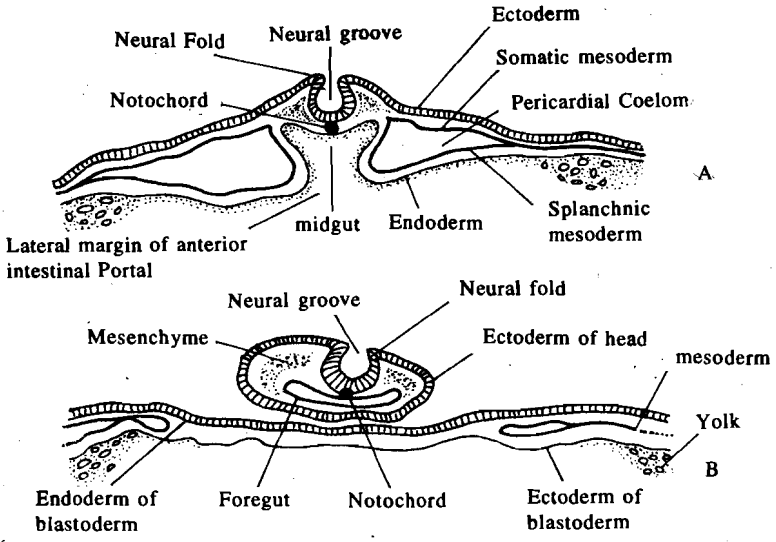

Fig. 27.7 : 24 hours chick embryo: T.S. passing through A head region and B mid body of embryo.

H CHICK EMBRYO, 33 HOURS (WHOLE MOUNT)

33 hours old embryo of chick shows some of the fundamental steps in the formation of central nervous system and circulatory system. You will notice remarkable changes in the development of the brain. Observe that the brain is differentiated into **prosencephalon** (fore-brain), **mesencephalon** (mid-brain), and **rhombencephalon** (hind-brain). The **optic vesicles** are established as paired lateral outgrowths of the prosencephalon. The optic vesicles soon extend to occupy the full width of the head. Infundibulum is formed in the floor of the prosencephalon. Mid-region of the heart is

considerably dilated and bent to the right. Twelve pairs of **somites** are formed. Anterior **omphalomesentric** veins have developed. Primitive streak becomes shorter because of the lengthening of the neural tube. **Proamnion, neural tube, notochord, sinus rhomboidalis and sinus terminalis** are also present (Fig. 27.8).

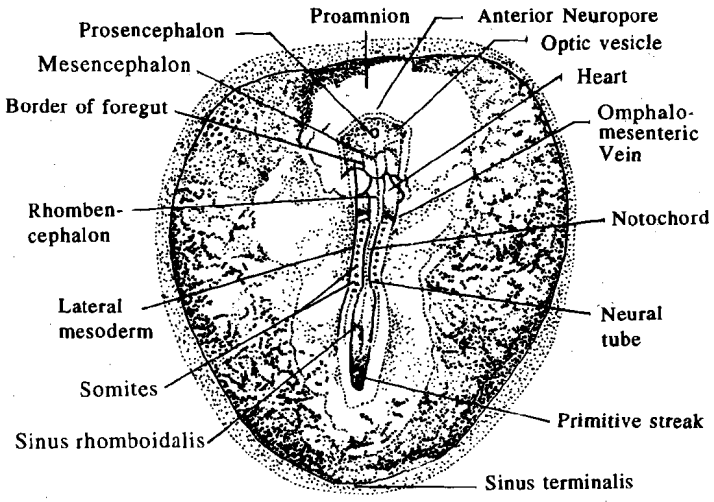

Fig. 27.8 : Chick embryo, 33 hours (W.M).

I T.S. OF 33 HOURS EMBRYO

Transverse section of 33 hours old embryo (Fig. 27.9) shows ectoderm, prosocoel, opticoel, mesenchyme, somatic mesoderm, splanchnic mesoderm and endoderm. The section shows mid structure namely, mesocoel, anterior cardinal vein, dorsal aortic root, somatopleure, extraembryonic coelom, splanchnopleure, foregut, notochord and ventral aortic root.

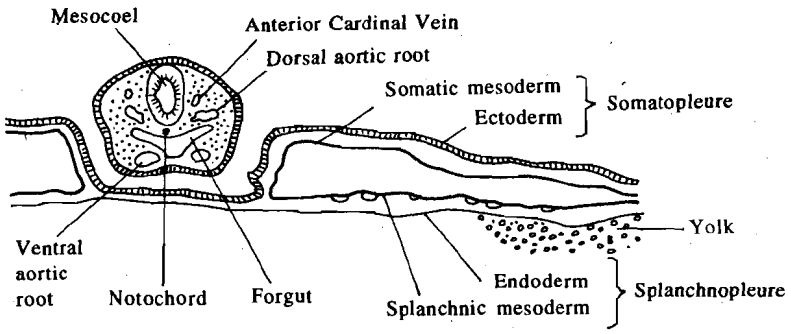

Fig. 27.9: T.S. of 33 hours old chick embryo.

J CHICK EMBRYO, 72 HOURS

72 hours old chick embryo (Fig. 27.10) is affected throughout by torsion and entire body is turned through 90°. Torsion is complete, well posterior to the level of heart, but the caudal portion of embryo is not turned on its side. Due to the cranial and **cervical flexures,** the long axis of the embryo shows nearly right angled bends in the mid brain and in the neck region. The mid body becomes concave. Visceral arches develop. Mandibular arch forms caudal boundary of oral depression and becomes more distinct. Nasal pits appear as shallow depressions. Cephalization is going on. Telencephalon also develops. In the eye, lens, sensory and pigmented layers are differentiated. Number of somites increases to 36 pairs. **Vitelline arteries and Vitelline veins** also make their appearance.

K CHICK EMBRYO, 96 HOURS

In 96 hours old embryo (Fig. 27.11), the entire body has been turned through 90° and the embryo lies with its left side on the yolk. At the end of 96 hours the body folds

have undercut the embryo so that it remains attached to the yolk only by a slender stalk. The yold stalk soon becomes elongated, allowing the embryo to become first straight in the mid-dorsal region and then dorsally.

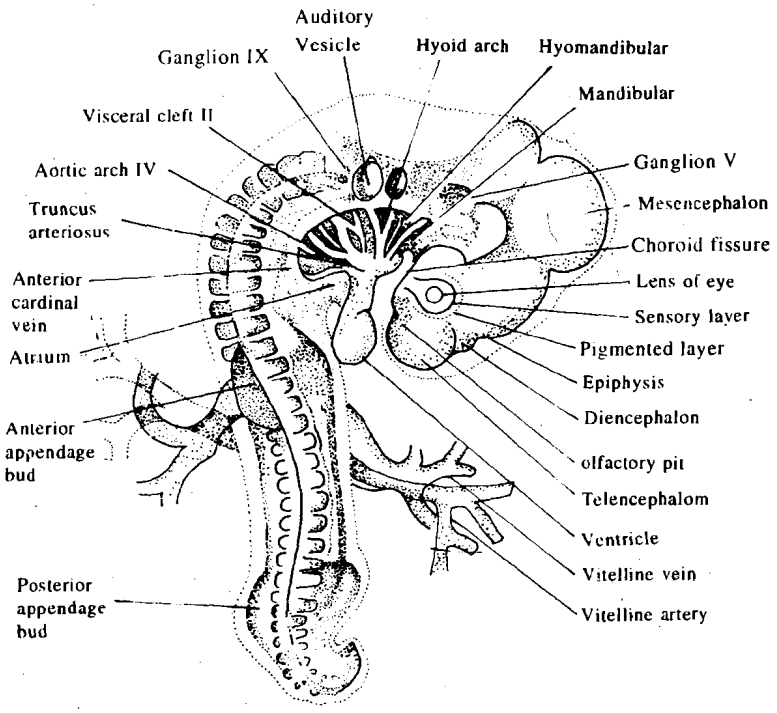

Fig. 27.10 : Chick embryo, 72 hours (W.M.).

The progressive increase in the cranial, cervical, dorsal and caudal flexures results in the bending of the embryo on itself so that its originally straight long axis becomes C shaped and its head and tail lie close together. Optic cup shows the more developed lens. **Endolymphatic** duct arises from the auditory vesicle. Visceral arches have become very much thickened. Appendage buds increase rapidly in size and become elongated. The number of somitees increases to 41 pairs. Allantois has also appeared. Omphalomesentric artery and omphalomesentric vein are also developed.

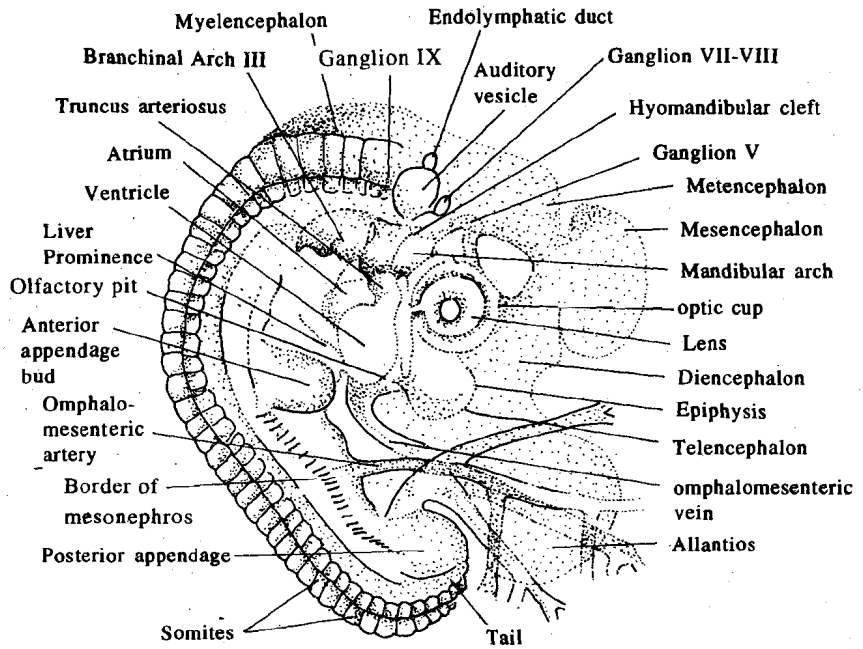

Fig. 27.11 : Chick embryo, 96 hours (W.M.).