

**FIG. 3-1**  
 A view of the right half of the late trilaminar blastocyst (embryonic shield period) showing its relation to the surrounding trophoblastic layer, connecting stalk, amniotic and yolk sac cavities and allantois.  
**The late trilaminar blastocyst with a notochordal process**

**Stage 7**  
**Age 16 to 17 days**  
**Carnegie collection 7802**  
**Reference**

Heuser CH, Rock J, Hertig AT: Two human embryos showing early stages of the definitive yolk sac. *Contrib Embryol Carnegie Instrn* 31:85-99, 1945

# the third week of life

## late trilaminar and embryonic shield period

### I. EMBRYO PROPER

Figs. 3-1,3-2

1. The *embryonic disc* is symmetrical and slightly convex in the longitudinal axis in its cranial half.
2. In the caudal half of the disc the ectodermal and endodermal layers are in contact in the midline. The area of contact is called the *cloacal membrane*.
3. Cranial to the cloacal membrane the ectodermal cells are loosely arranged to form the *primitive knot*.
4. Extending cranially from the knot, between ectoderm and endoderm, is a median clump of cells known as the *notochordal* or *head process*.
5. The *primitive streak* extends caudally from the knot as a faint zone of ectodermal proliferation in the midline. A shallow furrow, called the *primitive groove*, forms in the ectoderm over the caudal end of the streak.
6. A loose sheet of embryonic *mesoderm* develops lateral and cranial to the streak between ectoderm and endoderm. It probably has three sources: a) ectoderm in the area of the primitive streak, b) endoderm where mesoderm is in close contact and c) extraembryonic mesoblasts.

### II. EXTRAEMBRYONIC MEMBRANES

Figs. 3-1,3-2

Other than enlargement, no significant changes occur in the first half of the third week in the *secondary yolk sac*, *amnion* and *connecting stalk*. The *allantois* extends farther into the connecting stalk at the caudal end of the disc.

**FIG. 3-2**

**SECTION 1**

A section through the cranial part of the embryonic disc.

Observe:

1. The notochordal process between ectoderm and endoderm.
2. The slight convexity of the ectoderm in the midline.
3. The turned up margins of ectoderm that are continuous with the inner layer of the amnion.
4. Scant amounts of mesoderm that are continuous with extraembryonic mesoblasts.

**SECTION 2**

A section through the primitive knot.

Observe:

1. The knot has not yet produced a noticeable localized elevation of the ectoderm.
2. The knot is caused by a rearrangement of cells in the middle of the ectoderm.

**SECTION 3**

A section through the cranial part of the primitive streak.

Observe:

1. Cells comprising the embryonic mesoderm emerging from the deep side of the ectoderm and extending laterally.

**SECTION 4**

A section through the middle of the primitive streak.

Observe:

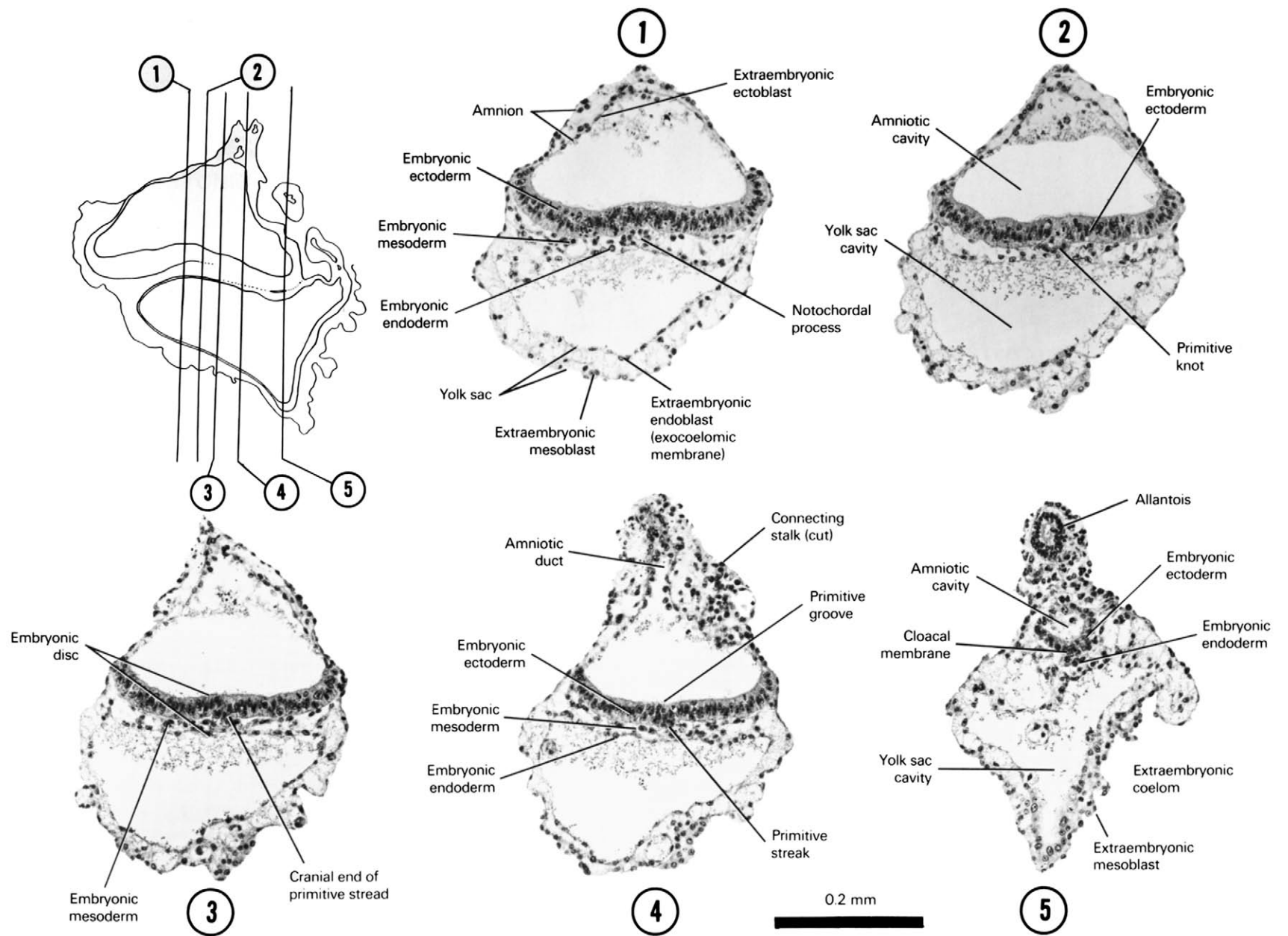
1. The slight depression in the ectoderm forming the primitive groove over the streak area.
2. The cut edge of the connecting stalk that attaches the embryo to the inner aspect of the chorion.
3. The amniotic duct extending into the stalk.

**SECTION 5**

A section through the caudal end of the embryonic disc.

Observe:

1. The cloacal membrane where ectoderm and endoderm come in contact.
2. The detached part of the allantois.
3. The caudal edge of the amniotic cavity.



# the third week of life

## early neural groove period

### 1. EMBRYO PROPER

Figs. 3-3 to 3-5

#### A. ECTODERM

1. In the cranial one-fourth of the embryo, the ectodermal layer forms a gentle arch from side to side. Caudal to this area there develops a shallow, broad, median furrow called the *neural groove*, which lies over the notochordal process described below. The floor of the furrow is the *neural plate*, which is bound on each side by *neural folds*. The neural plate is the first appearance of the *nervous system*.
2. *Lateral body folds* develop, resulting in the ectoderm clothing the lateral as well as dorsal surfaces of the embryo.
3. The *primitive knot* becomes a prominent elevation of ectoderm in the midline at about the middle of the disc as a result of ectodermal proliferation.
4. The *notochordal process* extends beneath the ectoderm from the knot to near the cranial end of the disc. The ventral part of the process joins the underlying endoderm throughout most of its extent. The *notochordal* or *neurenteric canal* in the process communicates dorsally with the amniotic cavity through an opening caudal to the knot called the *primitive pit*. Ventrally the canal communicates with the yolk sac cavity through a gap in the endoderm.
5. The primitive groove becomes a distinct longitudinal furrow extending caudally from the knot in the midline ectoderm.
6. The two-layered *cloacal membrane* is caudal to the groove in the angle where the embryo joins the connecting stalk.

#### B. ENDODERM

1. The surface of the endodermal layer contains gentle elevations and depressions having cellular connections with the mesodermal layer.
2. In the cranial half of the embryo, the midline endoderm joins with the ventral side of the notochordal process.
3. A thickened area of midline endoderm known as the *prochordal plate* develops immediately in front of the notochordal process. After formation of the head fold, the plate area will become the cranial end of the foregut. It will fuse with the overlying ectoderm and together will form the *oropharyngeal membrane*.
4. Caudal to the cloacal membrane, the endoderm lines a blind, tubular duct called the *allantois*.

#### C. MESODERM

1. The mesodermal layer spreads laterally from the *primitive streak* and cranially on each side of the notochordal process. It is present at the cranial end of the disc but is very scant between the prochordal plate and overlying ectoderm.
2. It can be divided into *paraxial* and *lateral* portions.
3. Numerous junctions are present between the mesodermal and endodermal cells.
4. At the edge of the disc, embryonic mesoderm is continuous with extraembryonic mesoblasts.
5. Small, isolated spaces are forming in the cranial mesoderm at the edge of the disc. These spaces represent the first appearance of the *pericardial cavity*.

## II. EXTRAEMBRYONIC MEMBRANES

Figs. 3-3 to 3-5

### A. YOLK SAC

Distinct collections of cells called *blood islands* develop in the outer mesoblastic layer of the yolk sac, especially on its ventral surface. The blood islands produce the primitive blood cells. Many endothelial-lined spaces filled with primitive blood cells form in the mesoblastic layer. These spaces will soon become continuous with those forming in the connecting stalk, chorion and embryo proper. They represent the first appearance of the *Cardiovascular System*.

### B. AMNION

The two-layered amnion arches over the dorsal and lateral aspect of the embryonic disc as the lateral body folds develop.

### C. CONNECTING STALK

The connecting stalk bends at nearly right angles to the embryonic disc. It is wedge shaped, being narrow near the embryo and broad at its attachment to the chorion. The most advanced blood vessels are in the stalk near the embryo. These vessels are precursors of the umbilical vessels.

### D. ALLANTOIS

The allantois becomes a distinct, endodermally lined duct caudal to the cloacal membrane.

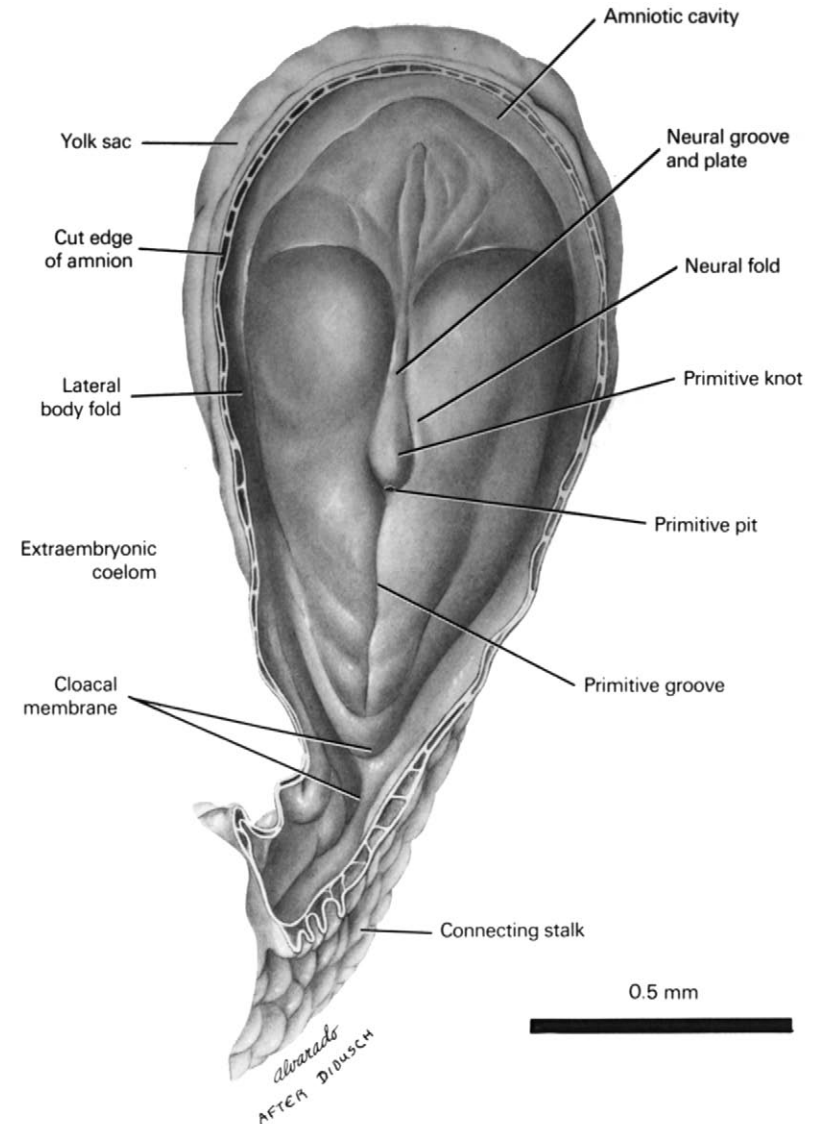


FIG. 3-3

A dorsal view of the presomite embryo in the early neural groove period showing midline specializations in the ectoderm and the relation of the embryo to the *amnion* (cut), *yolk sac* and *connecting stalk*. The *lateral body folds* give the embryo "sides."

The presomite embryo with a notochordal canal

Stage 8

Age 18 days

Carnegie collection 5960

Reference

Heuser CH: A presomite human embryo with a definite chordal canal. Contrib Embryol Carnegie Instn 23:251-267, 1932

#### **FIG. 3-4**

##### **SECTION 1**

A section through the cranial end of the embryonic disc.

Observe:

1. The relation of the three primary germ layers: ectoderm, endoderm and mesoderm.
2. A junction between endodermal and mesodermal cells.
3. The mesodermal layer at the edge of the disc is continuous with extra-embryonic mesoblasts forming the outer layer of the amnion and yolk sac.
4. The convexity of the thick ectodermal layer that forms the floor of the amniotic cavity.
5. The thin endodermal layer that forms the roof of the yolk sac cavity.

##### **SECTION 2**

A section through the cranial part of the embryonic disc showing the prochordal plate.

Observe:

1. The broader embryonic disc with the primary germ layers having characteristics similar to those in Section 1.
2. Another junction region between mesodermal and endodermal cells.
3. Thickened, midline endoderm forming the prochordal plate.
4. Small spaces in the mesoderm at the edge of the disc that will form the pericardial cavity.

##### **SECTION 3**

A section through the cranial part of the neural plate and the underlying notochordal process.

Observe:

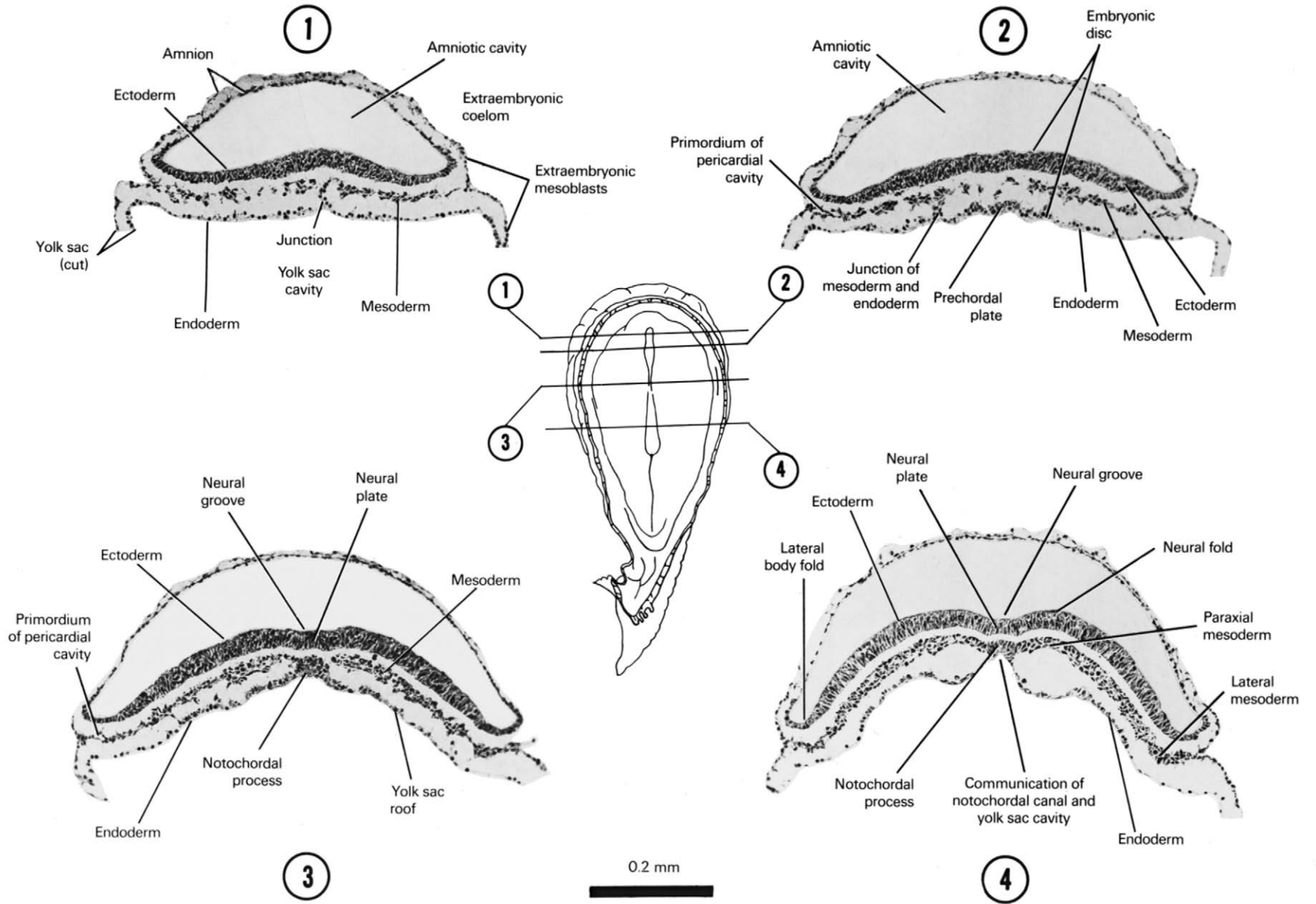
1. The ectoderm with the neural plate in the floor of a slight, broad median furrow, the neural groove.
2. The cranial part of the notochordal process, which is joined with the endodermal layer and makes contact with the mesodermal layer.

##### **SECTION 4**

A section through the middle of the neural plate and the notochordal process.

Observe:

1. The midline neural plate flanked on each side by a neural fold.
2. The lateral body folds with ectoderm covering the dorsal and lateral surfaces of the embryo.
3. The midline notochordal process having a platelike shape, which joins with endoderm and makes contact with mesoderm.
4. The communication of the notochordal canal with the yolk sac cavity.
5. The subdivisions of the mesodermal layer into paraxial and lateral portions.





**FIG. 3-5**

**SECTION 5**

A section through the cranial part of the primitive streak and the overlying primitive groove.

Observe:

1. The midline zone of proliferation of ectoderm, the primitive streak.
2. The layer of mesoderm that spreads laterally from the streak.
3. Lateral body folds that cause all three germ layers to arch from side to side.
4. The endodermal layer encroaching on the dorsal part of the yolk sac cavity.

**SECTION 6**

A section through the middle part of the primitive streak and groove.

Observe:

1. The prominent primitive groove over the primitive streak.
2. The thick layers of ectoderm and mesoderm.
3. The thin layer of endoderm that is beginning to enclose the dorsal part of the yolk sac cavity.

**SECTION 7**

A section through the cranial part of the cloacal membrane.

Observe:

1. The union of ectoderm and endoderm forming the cloacal membrane.
2. The more laterally situated mesoderm, which is continuous with the extraembryonic mesoblast.

**SECTION 8**

A section through the caudal part of the cloacal membrane.

Observe:

1. The allantois, which is located just caudal to the cloacal membrane and is lined with endoderm.
2. The allantois, which is an extension of the yolk sac cavity that ends blindly in the connecting stalk.
3. A blood island in the tissue of the connecting stalk.
4. The two-layered amnion.

