Embryology

Lecture 2

2nd Week

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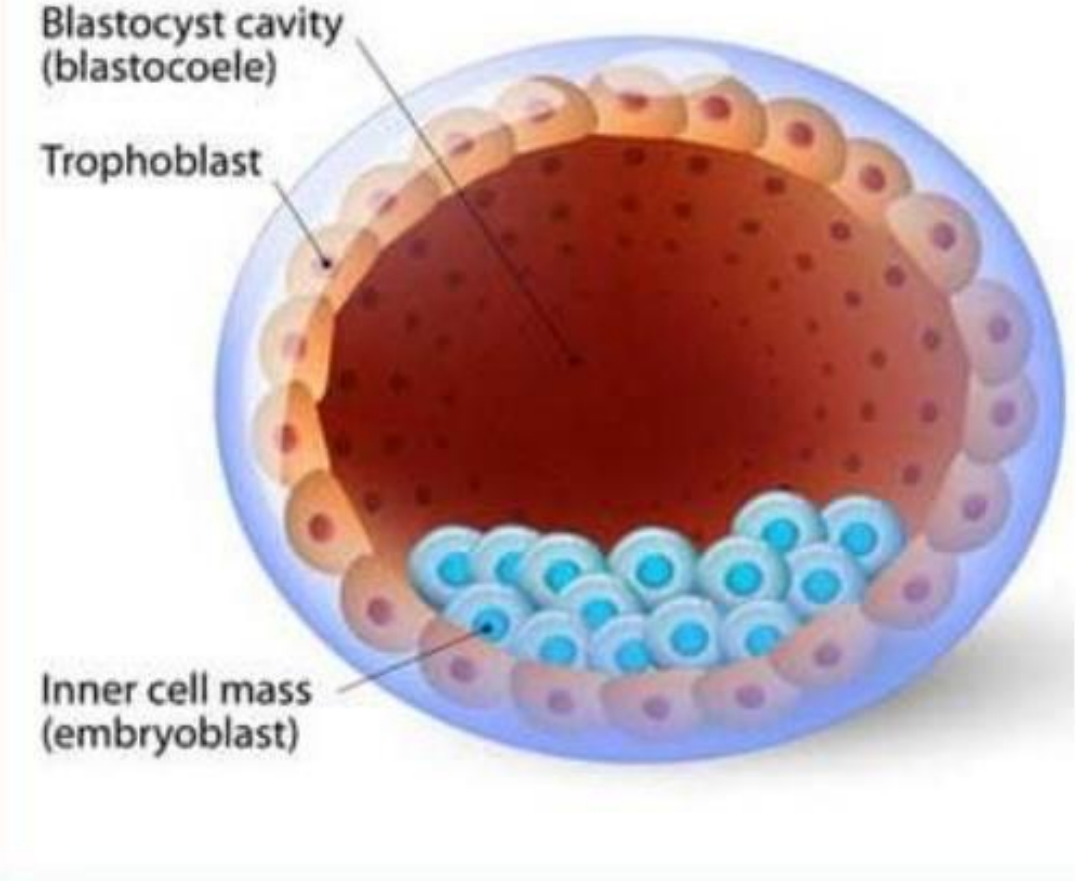
2nd Week

The most important features of the second week is:

- ✓ Completion of implantation
- ✓ Establishment of fetomaternal interactions.

Blastulation:

- ➢ Development of blastocyst:
  - **Trophoblast cells** ⟶ placenta
  - **Embryoblast** ⟶ embryo.



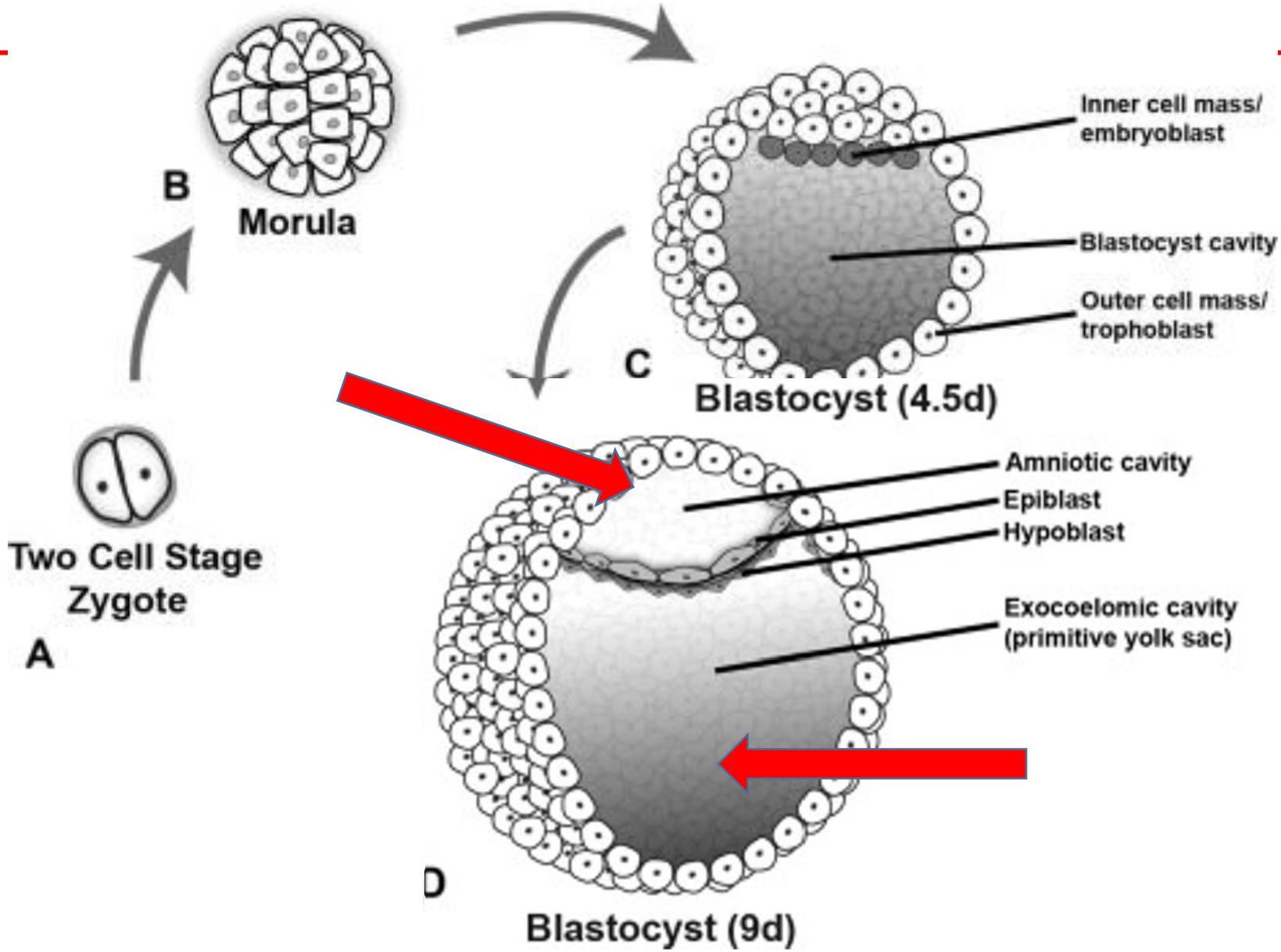
When the blastocyst gets in the uterus

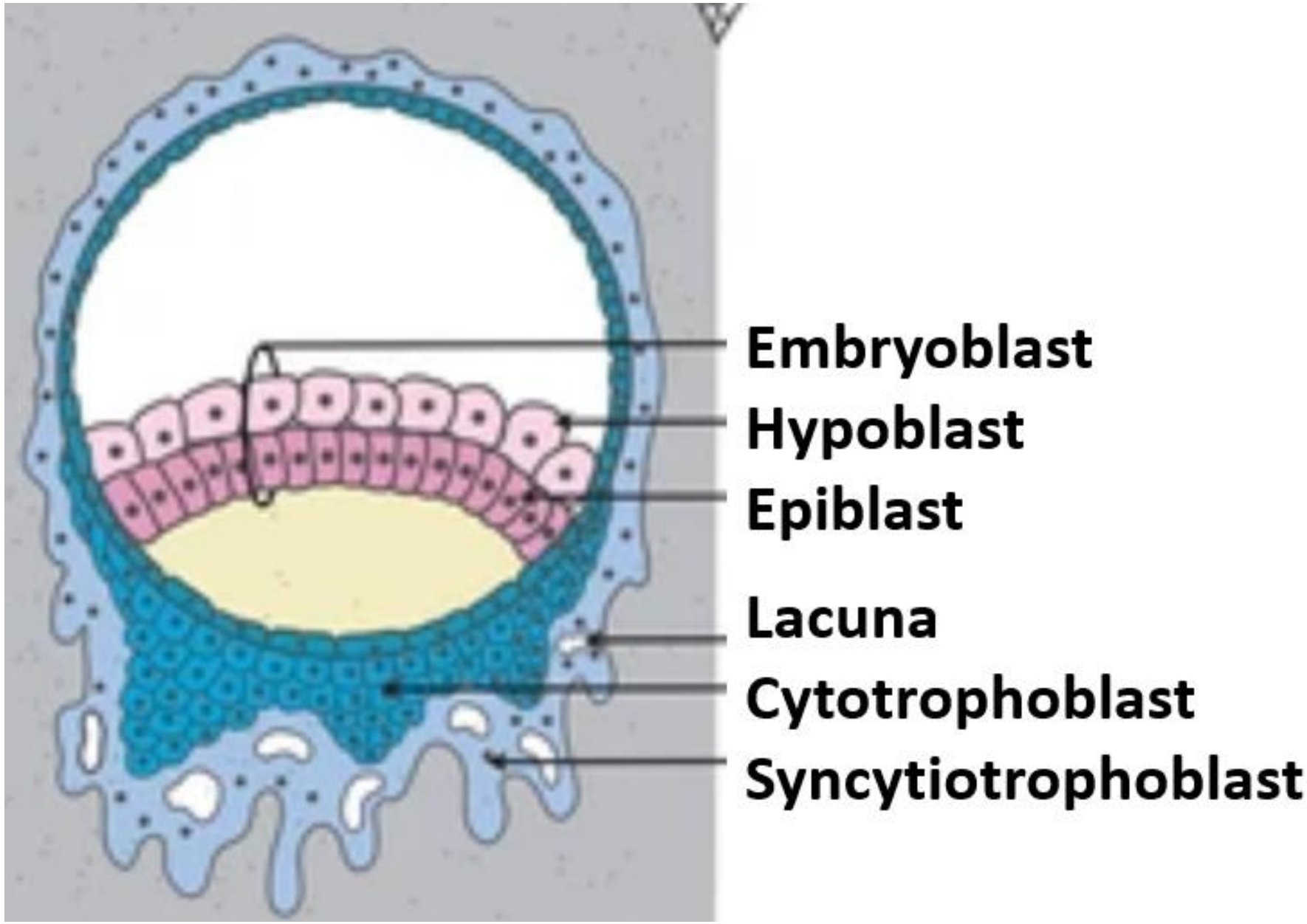
- ✓ Zona pellucida degenerates.
- ✓ Syncytiotrophoblast ⟶ Proteolytic enzymes

The 2nd week is the **week of twos:**

- ✓ **Embryoblast and trophoblast** each separate into two distinct layers.
- ✓ 2 cavities are developed:

- **Amniotic sac**: a cavity of fluid that develops “above” the epiblast (between epiblast and cytotrophoblast)
- **Primary yolk sac**: a cavity that forms “below” the hypoblast (between hypoblast and cytotrophoblast)


Two Cell Stage
Zygote
A
B
Morula
C
Inner cell mass/
embryoblast
Blastocyst cavity
Outer cell mass/
trophoblast
Blastocyst (4.5d)
Amniotic cavity
Epiblast
Hypoblast
Exocoelomic cavity
(primitive yolk sac)
D
Blastocyst (9d)


Embryoblast
Hypoblast
Epiblast
Lacuna
Cytotrophoblast
Syncytiotrophoblast

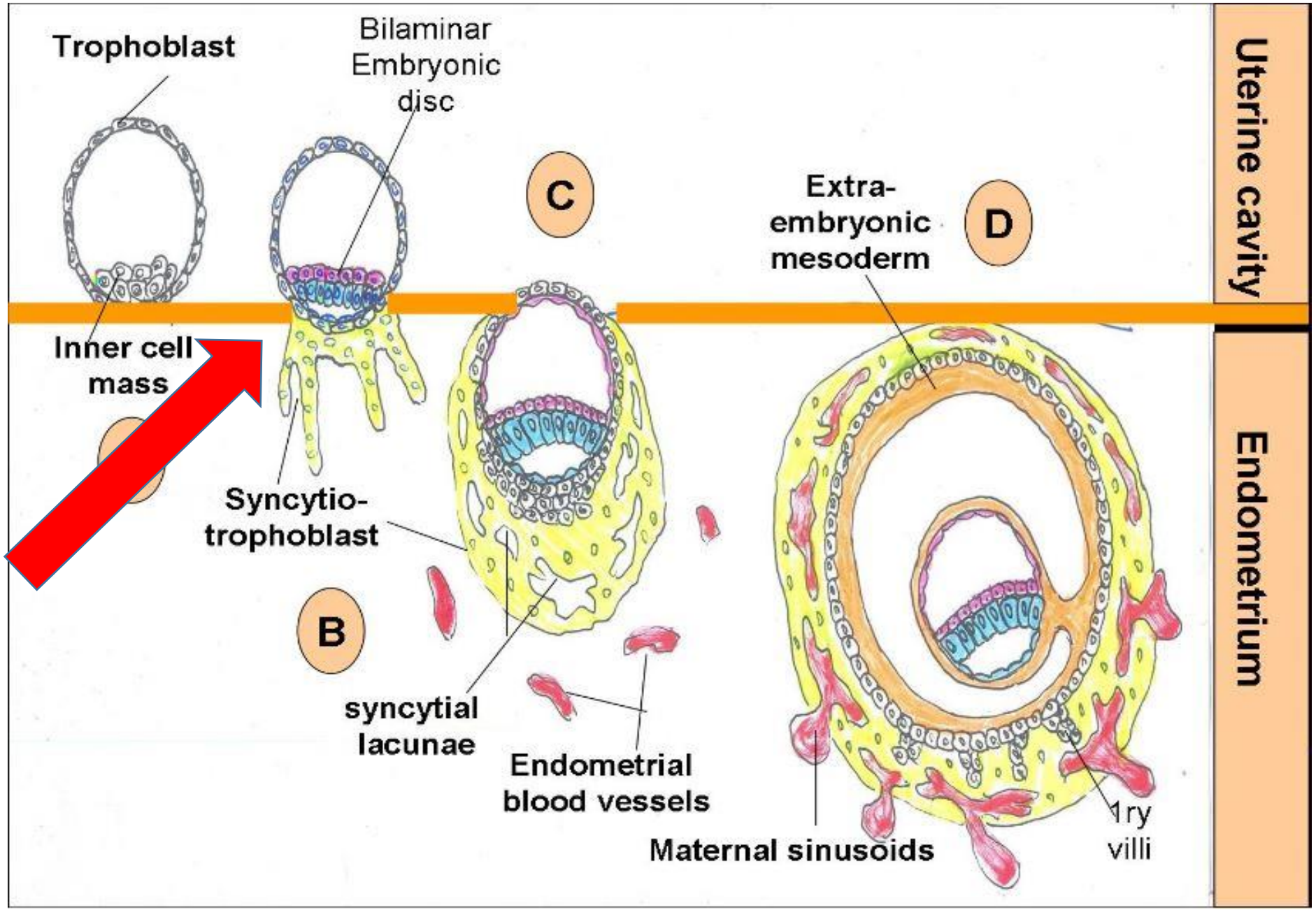
Implantation

- ✓ Begins in the 1st week and extends into the 2nd week.
- ✓ Endometrial lining thickened and highly vascular
- ✓ The placenta develops
- ✓ Vacuoles will appear in the syncytiotrophoblast and will filled by blood
- ✓ Maternal capillaries erode
- ✓ Uteroplacental circulation
- ✓ Syncytiotrophoblast stimulates the release of progesterone from the corpus luteum.

Implantation

- ✓ The embryo is joined to the trophoblastic shell by a narrow connecting stalk that develops into the umbilical cord to attach the placenta to the embryo.

2nd Week


Trophoblast
Bilaminar Embryonic disc
C
Extra-embryonic mesoderm
D
Uterine cavity
Inner cell mass
Syncytio-trophoblast
B
syncytial lacunae
Endometrial blood vessels
Maternal sinusoids
1ry villi
Endometrium

3rd Week

- ✓ The most characteristic event occurring during the 3rd week is **gastrulation**
- ✓ Gastrulation begins with the appearance of the **primitive streak**
- ✓ **Primitive streak** has at its cephalic end the **primitive node**.

3rd Week

- ✓ **Gastrulation** involves: **migration**, **invagination** and **differentiation** of the epiblast
- ✓ Controlled by the **primitive streak**.

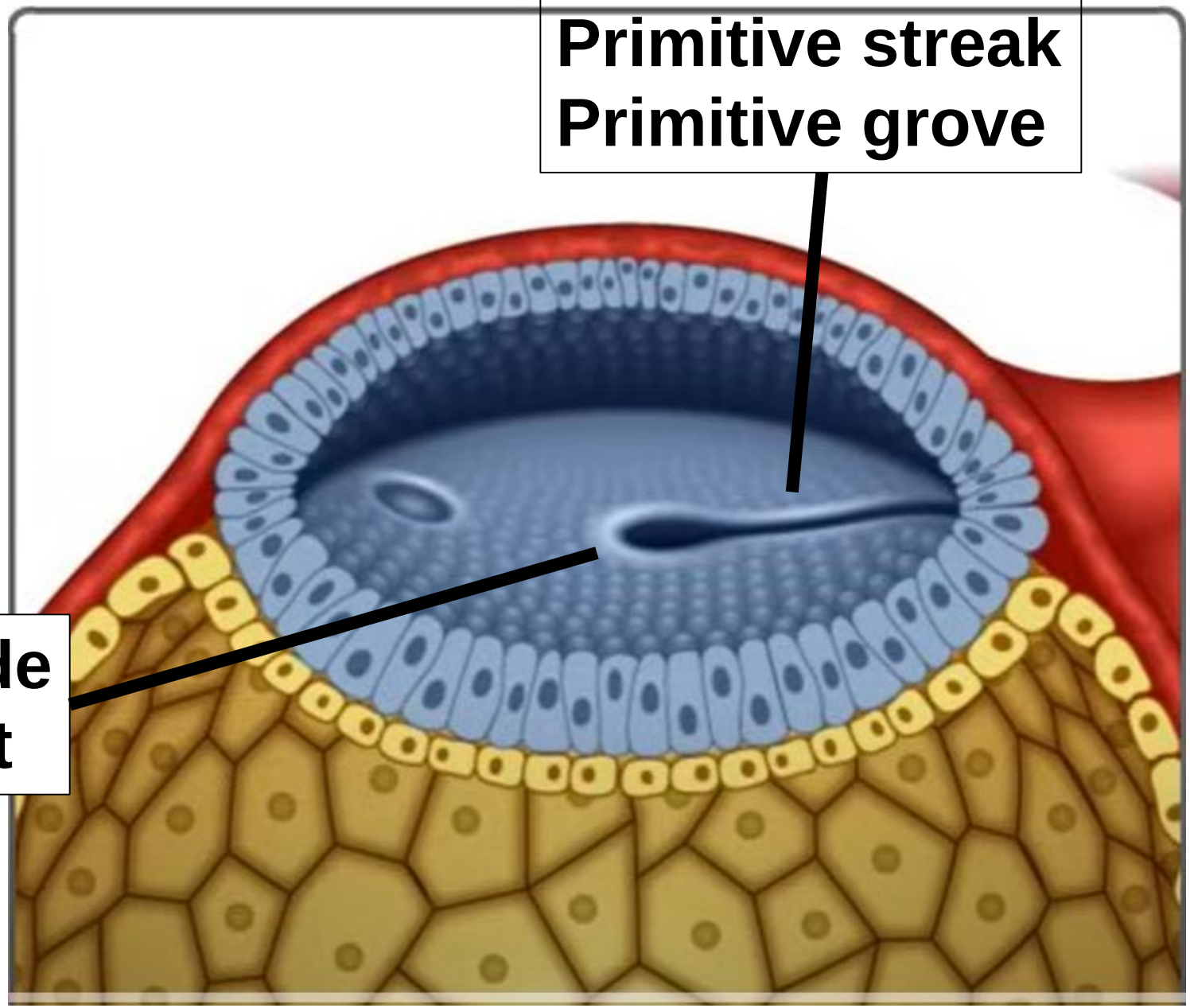
The primitive streak:

- ✓ A thickened linear band in the caudal end, primitive node at the cranial end
- ✓ Primitive pit and node
- ✓ Embryonic axes

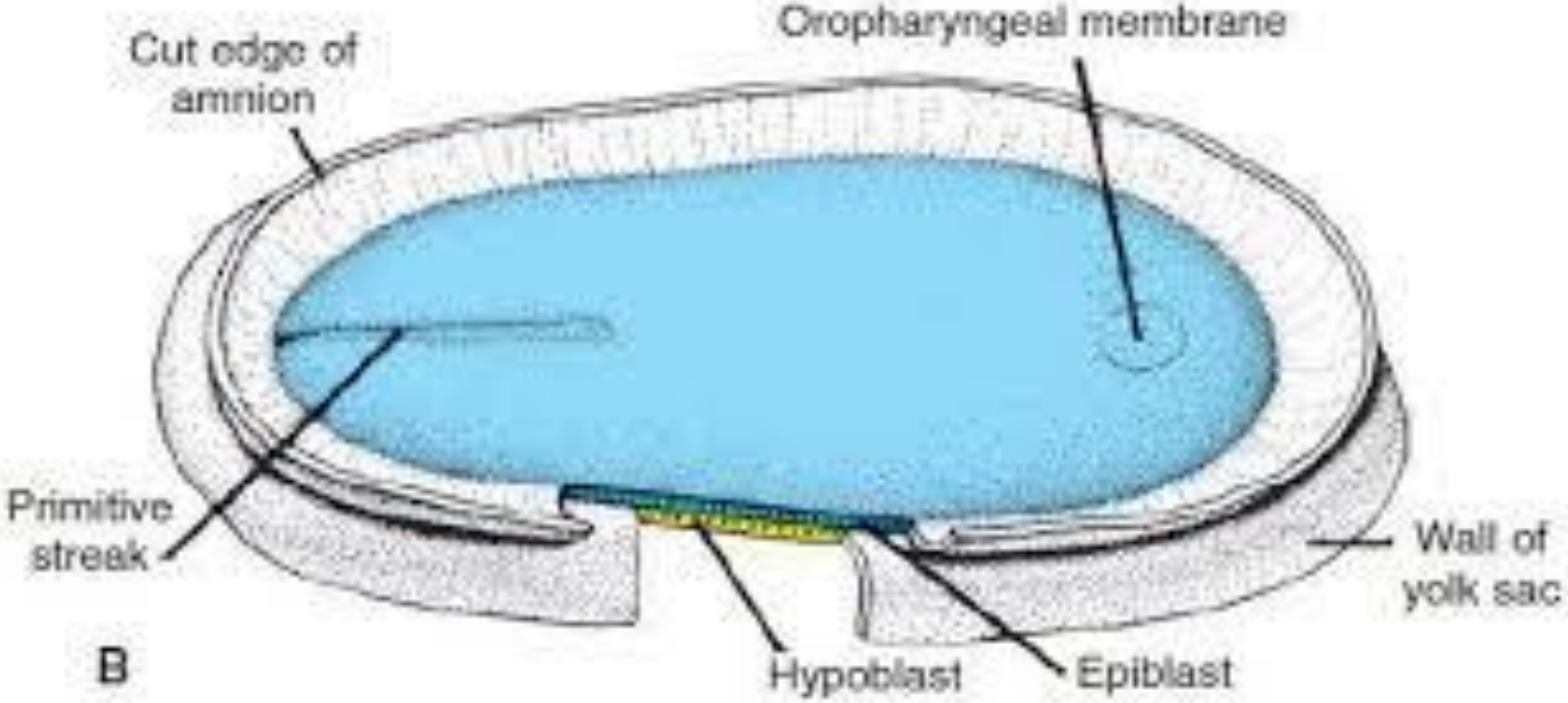
3rd Week

Cephalic end

Caudal end



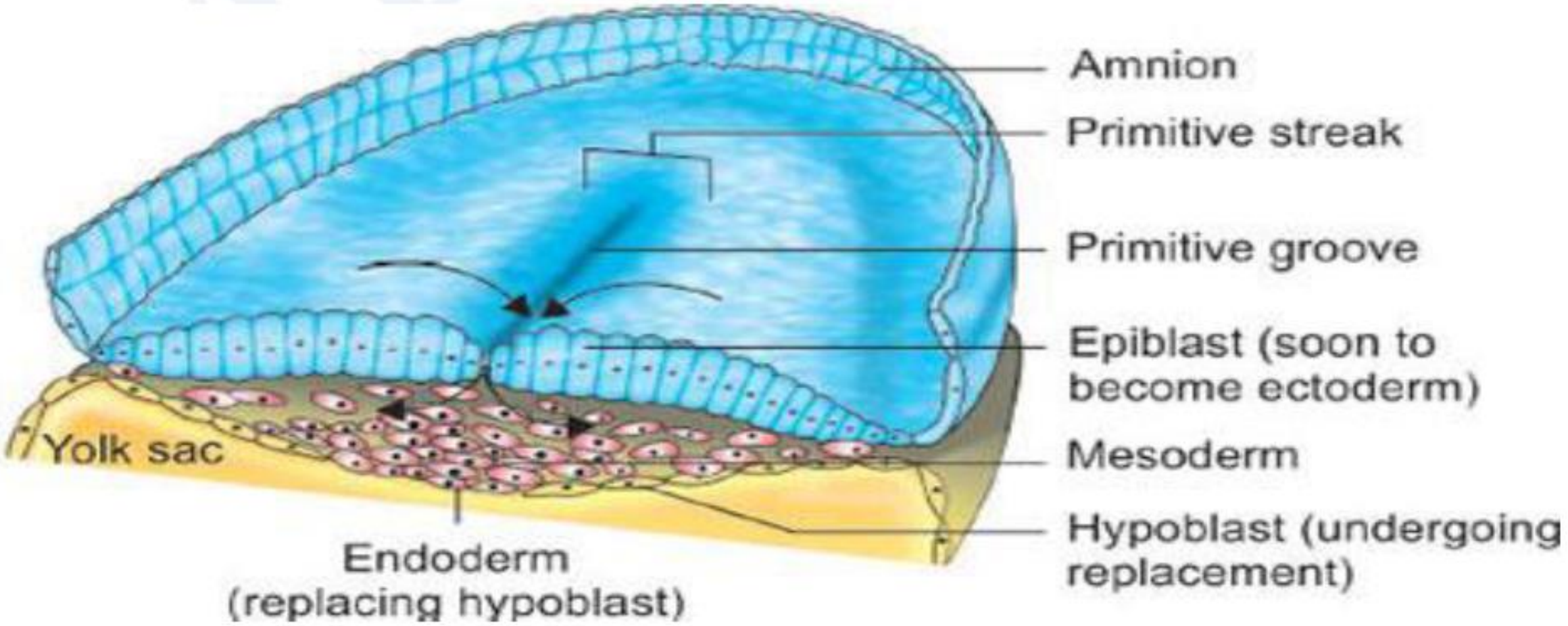
3rd Week


Cut edge of amnion
Oropharyngeal membrane
Primitive streak
Wall of yolk sac
B
Hypoblast
Epiblast

3rd Week

- ✓ In the region of the node and streak, **epiblast** cells move inward **(invaginate)** to form new cell layers, **endoderm** and **mesoderm**. Cells that do not migrate through the streak but remain in the epiblast form **ectoderm.**
- ✓ **E**piblast gives rise to all three **germ layers** in the embryo, **ectoderm, mesoderm**, and **endoderm**, and these layers form all of the tissues and organs.

3rd Week


Amnion
Primitive streak
Primitive groove
Epiblast (soon to become ectoderm)
Mesoderm
Hypoblast (undergoing replacement)
Yolk sac
Endoderm
(replacing hypoblast)

3rd Week

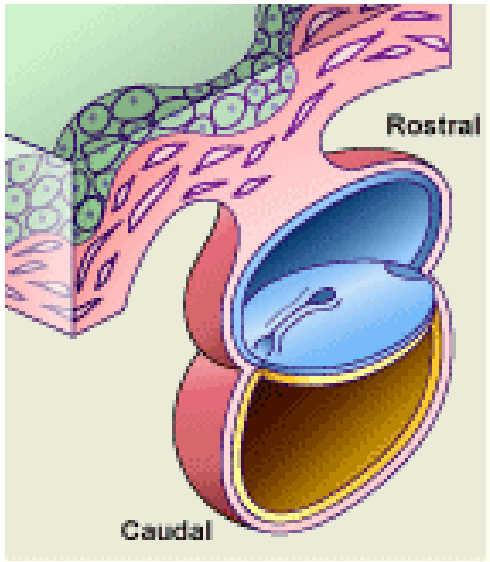
By the middle of week 3, intraembryonic mesoderm separates the ectoderm and endoderm everywhere except at:

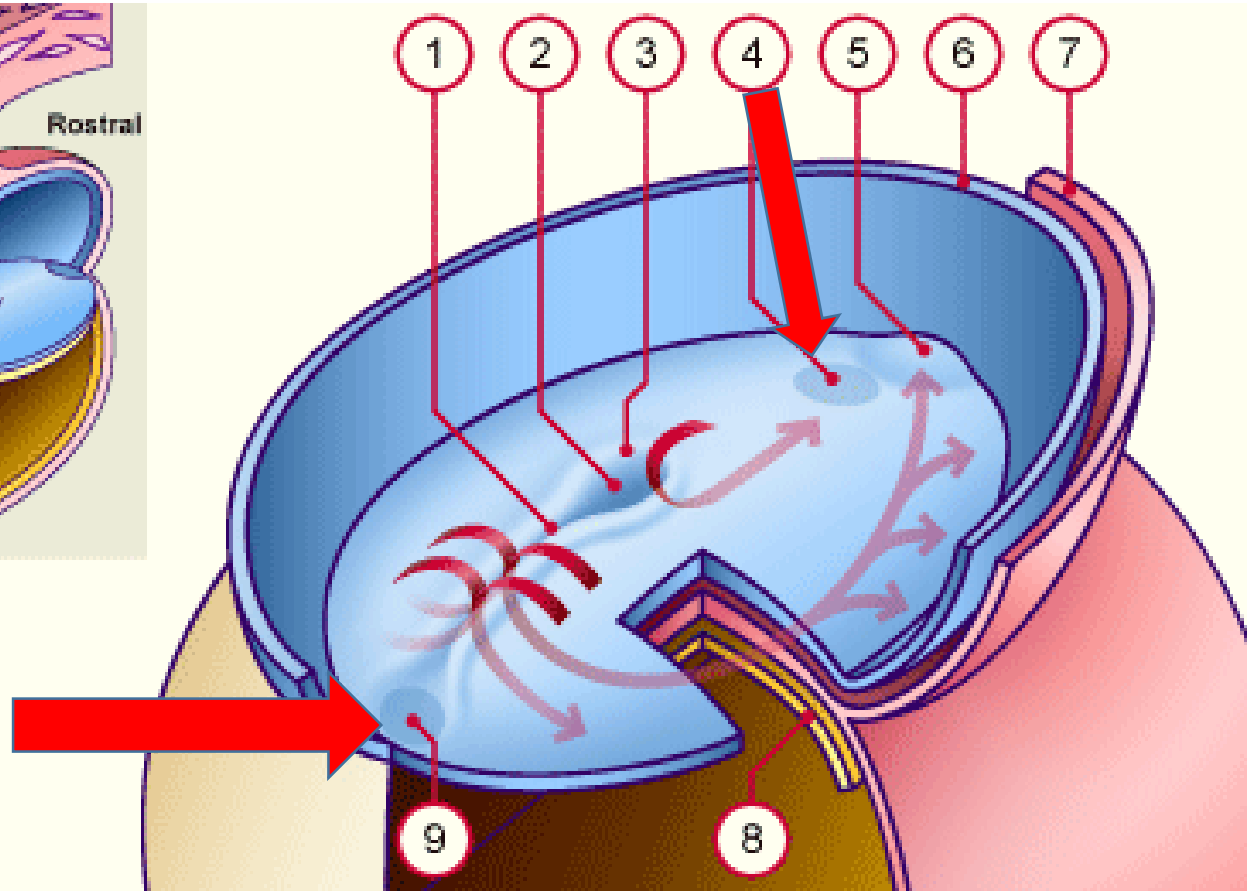
- ✓ **Oropharyngeal membrane cranially**
- ✓ **Cloacal membrane caudally**
- ✓ **In the midline, cranial to the primitive node where the notochordal process extends.**

Because embryonic ectoderm and endoderm fuse at these sites and prevent mesenchymal cells from migrating between them.

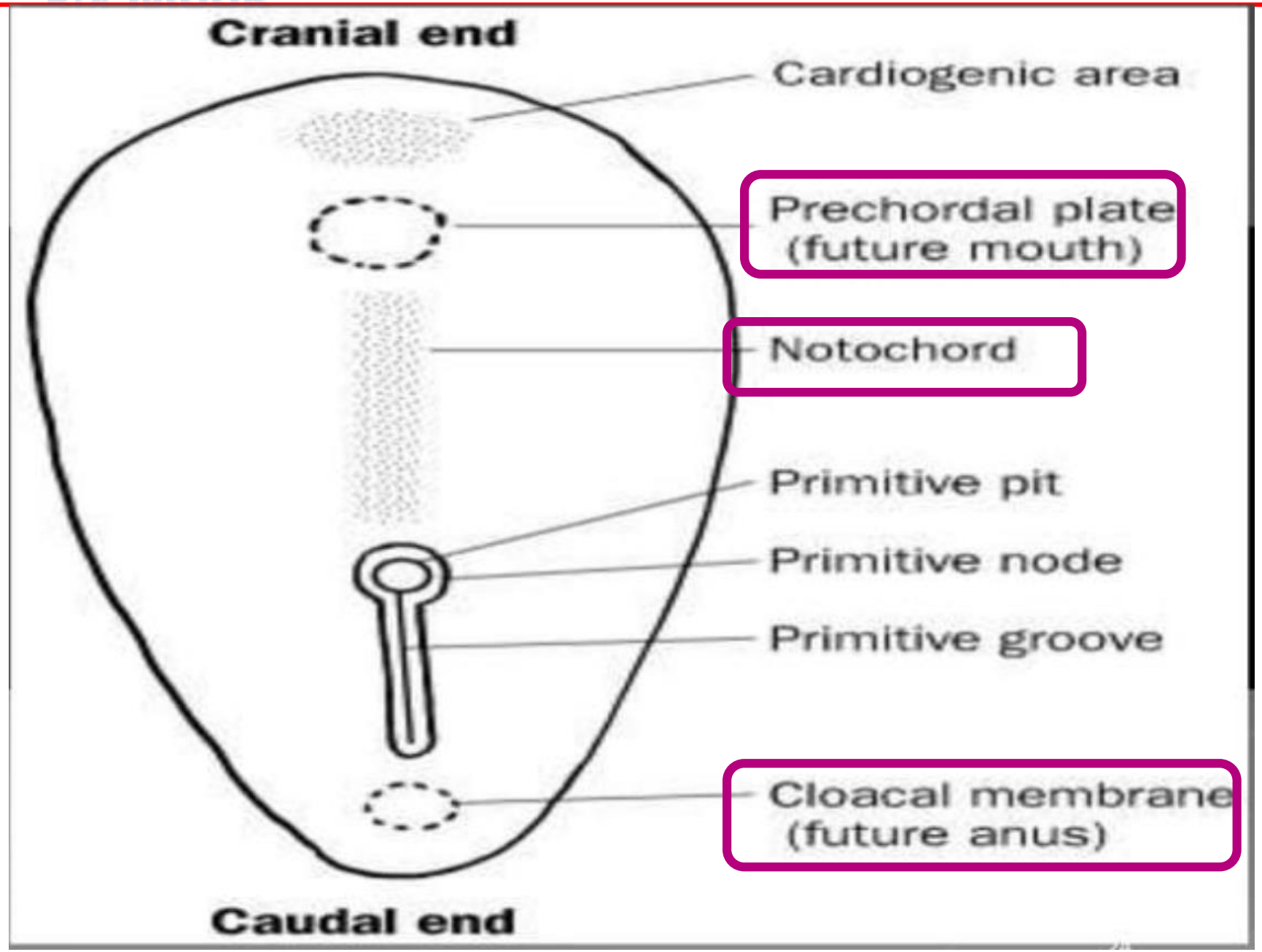
3rd Week

1.Primitive groove
2.Primitive pit
3.Primitive node
4.Oropharyngeal membrane
5.Cardiogenic plate
6.Sectional edge of amniotic membrane
7.Mesoderm
8.Endoderm
9.Future cloacal membrane





3rd Week



No mesoderm

3rd Week

- ✓ Invagination of surface cells in the primitive streak and their subsequent migration forward and laterally continues until the end of the **4th week**.

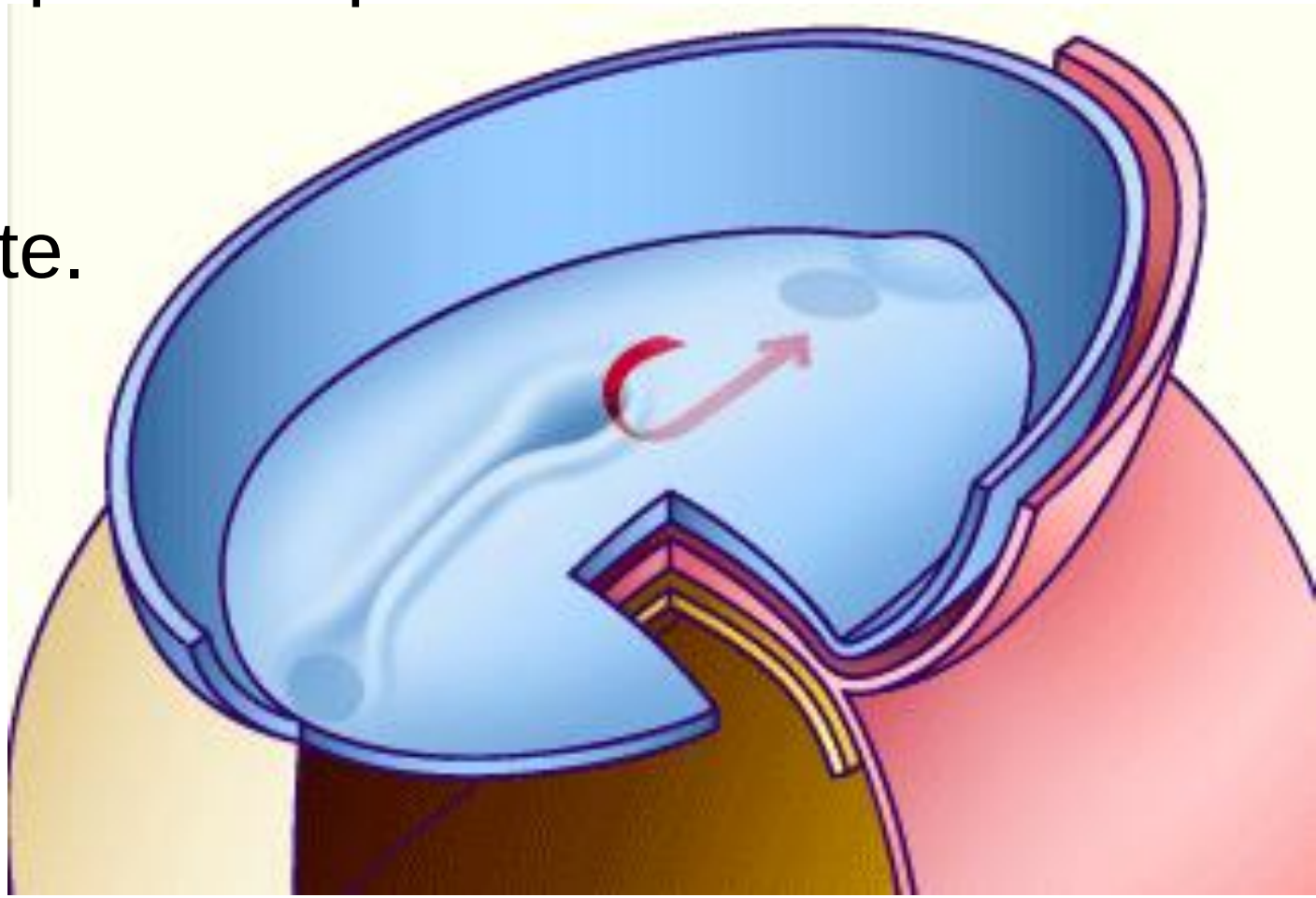
- ✓ At that stage, the primitive streak shows regressive changes, rapidly **shrinks, and soon disappears**.

3rd Week

- ✓ Prenotochordal cells invaginating in the primitive between ectoderm and endoderm and move forward (cranially) until they reach the prechordal plate.
- ✓ They intercalate in the endoderm as the **notochordal plate**. With further development, the plate detaches from the endoderm, and a solid cord, the **notochord**, is formed.
- ✓ It forms a midline axis, which will serve as the basis of the axial skeleton.

Notochord

- ✓ Prenotochordal cells in the primitive pit
- ✓ Invaginating forward
- ✓ Stopped by prechordal plate.

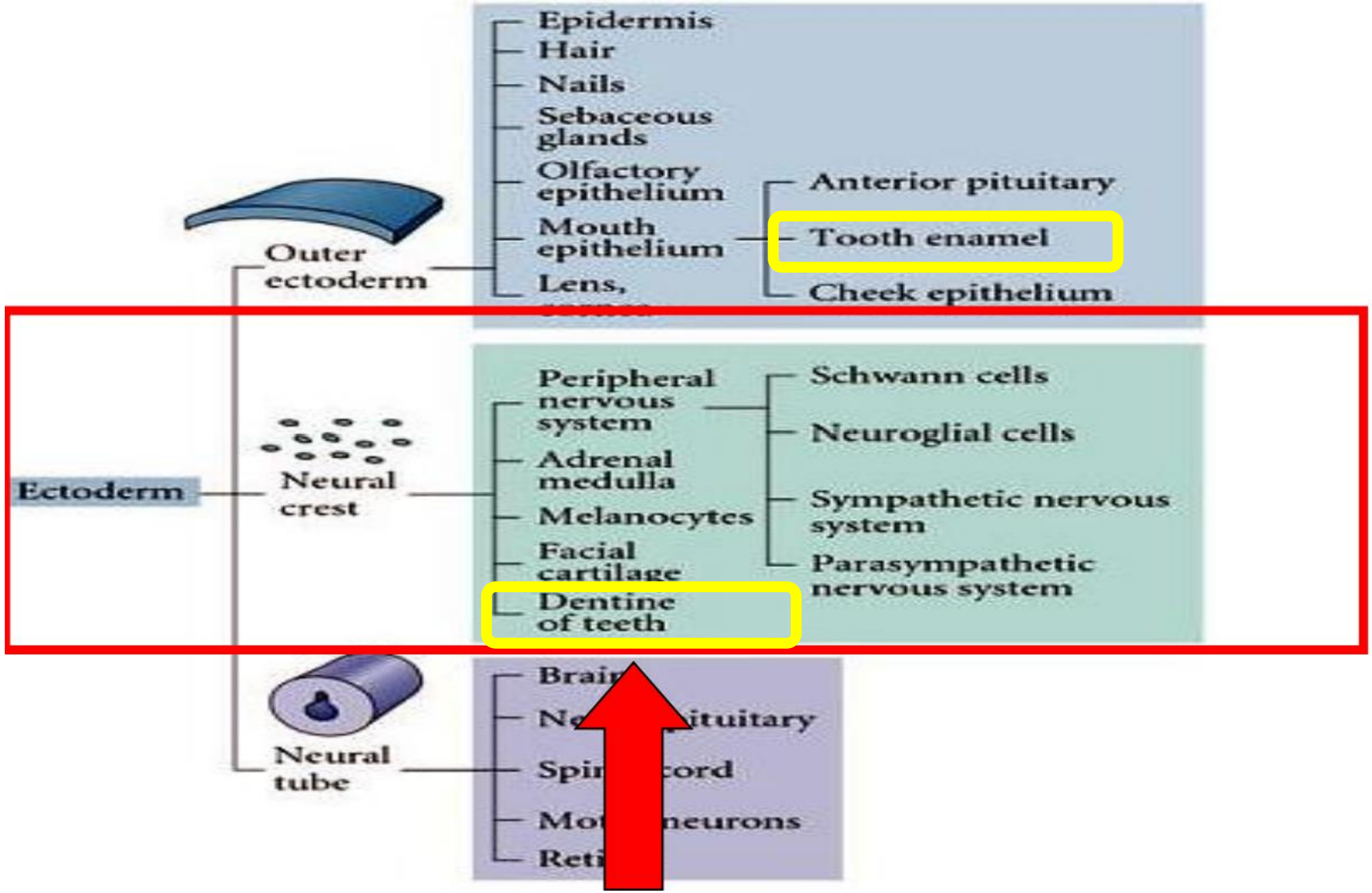


Neural Crest Cells

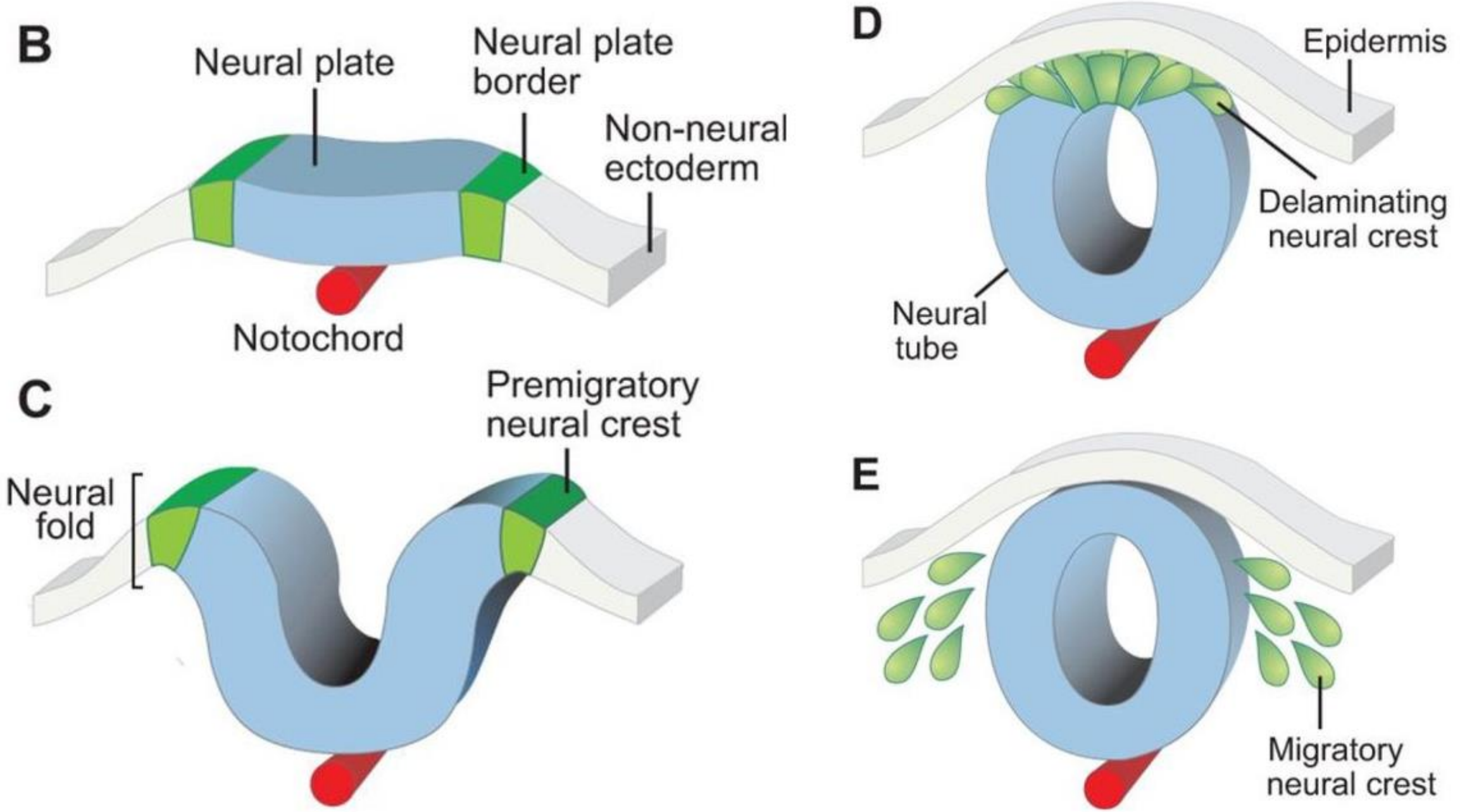
- ✓ These cells contribute to the formation of the **peripheral nervous system**

- ✓ Neural crest cells are so fundamentally important and contribute to so many organs and tissues that they are sometimes referred to as **The Fourth Germ Layer**.

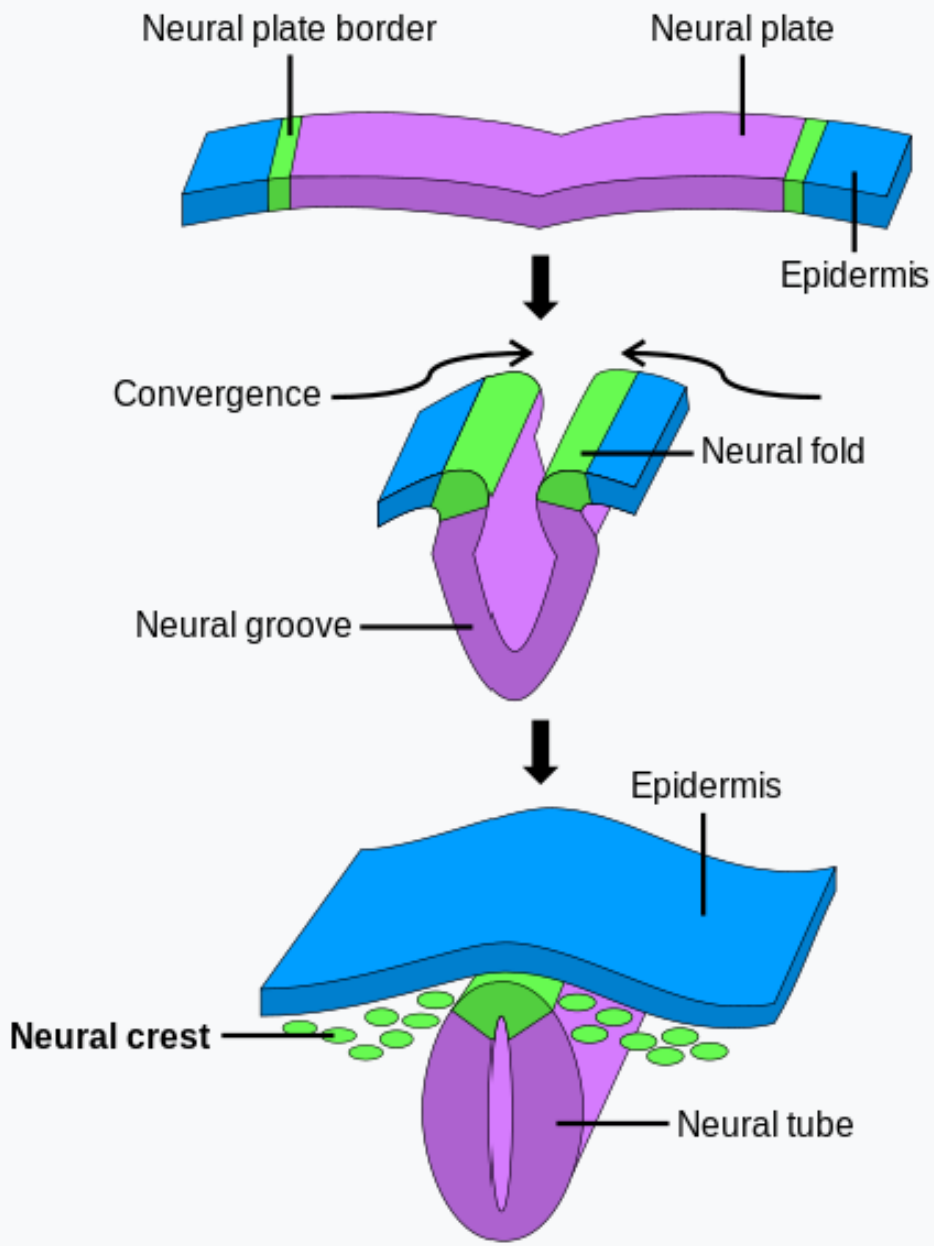
Neural Crest Cells



Neural Crest Cells



Neural crest



Neural Crest:

These cells contribute to the formation of the peripheral nervous system

