

The First Three Weeks of Human Embryogenesis

Week 1

- **1. Fertilization** – is the fusion of the **sperm** and **ovum** (male and female gametes) = Zygote formation

(in the uterine tube) :

- - distant phase – sperms find ovum;
- - contact phase – 1 sperm fertilizes ovum.

Week 1

- Zygote – 1 cell embryo – starts to divide:
- 2. **Cleavage** – is the division of the zygote inside zona pellucida = Blastula formation

Fertilization

Cleavage

2 cells stage

3-5 cells stage

Blastula
Morula

Blastocyst

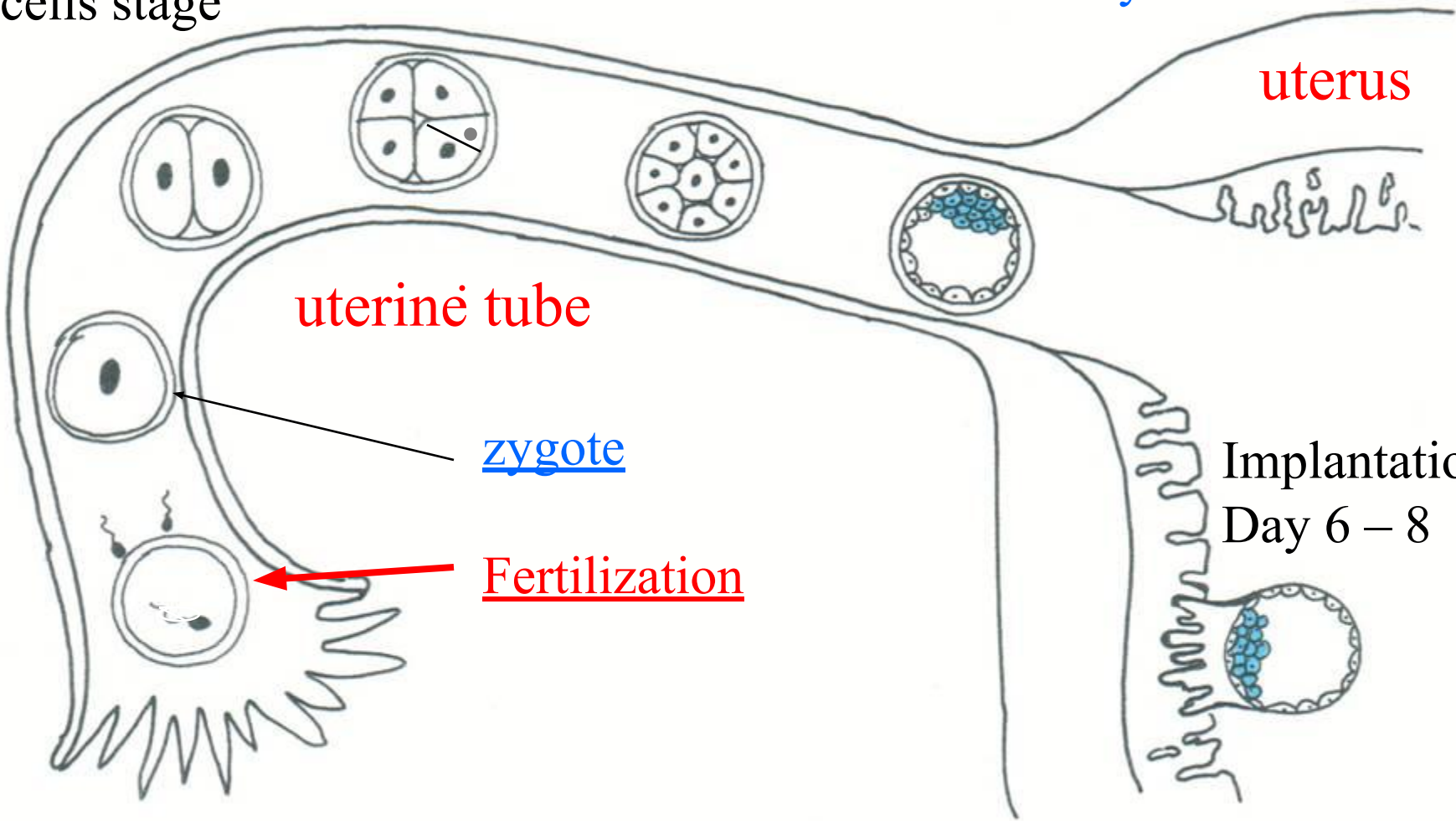
uterus

uterine tube

zygote

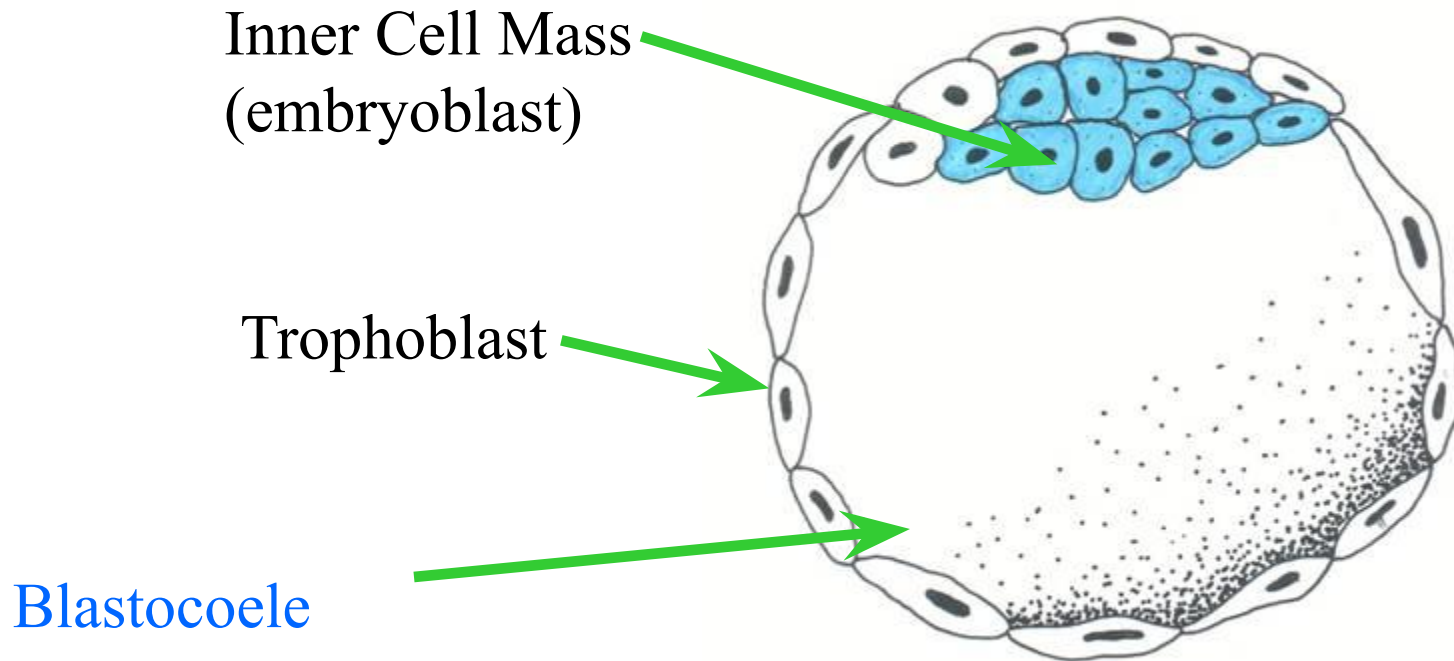
Fertilization

Implantation
Day 6 – 8



At the end of cleavage **blastula** is formed.
Human blastula is called **blastocyst** (has cavity
=cyst)

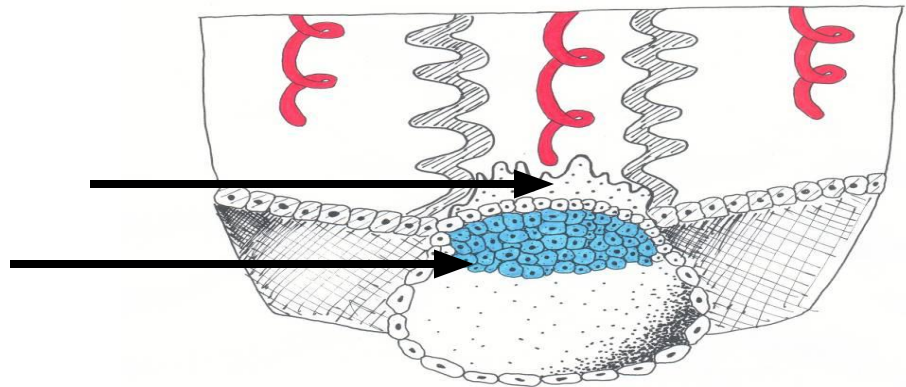
Blastocyst consists of **outer cells (trophoblast)**,
inner cells (embryoblast) and **cavity - Blastocoele**.



At the 7-th day
blastocyst sinks into the uterine wall
due to activity of trophoblast – implantation.

Trophoblast

Embryoblast

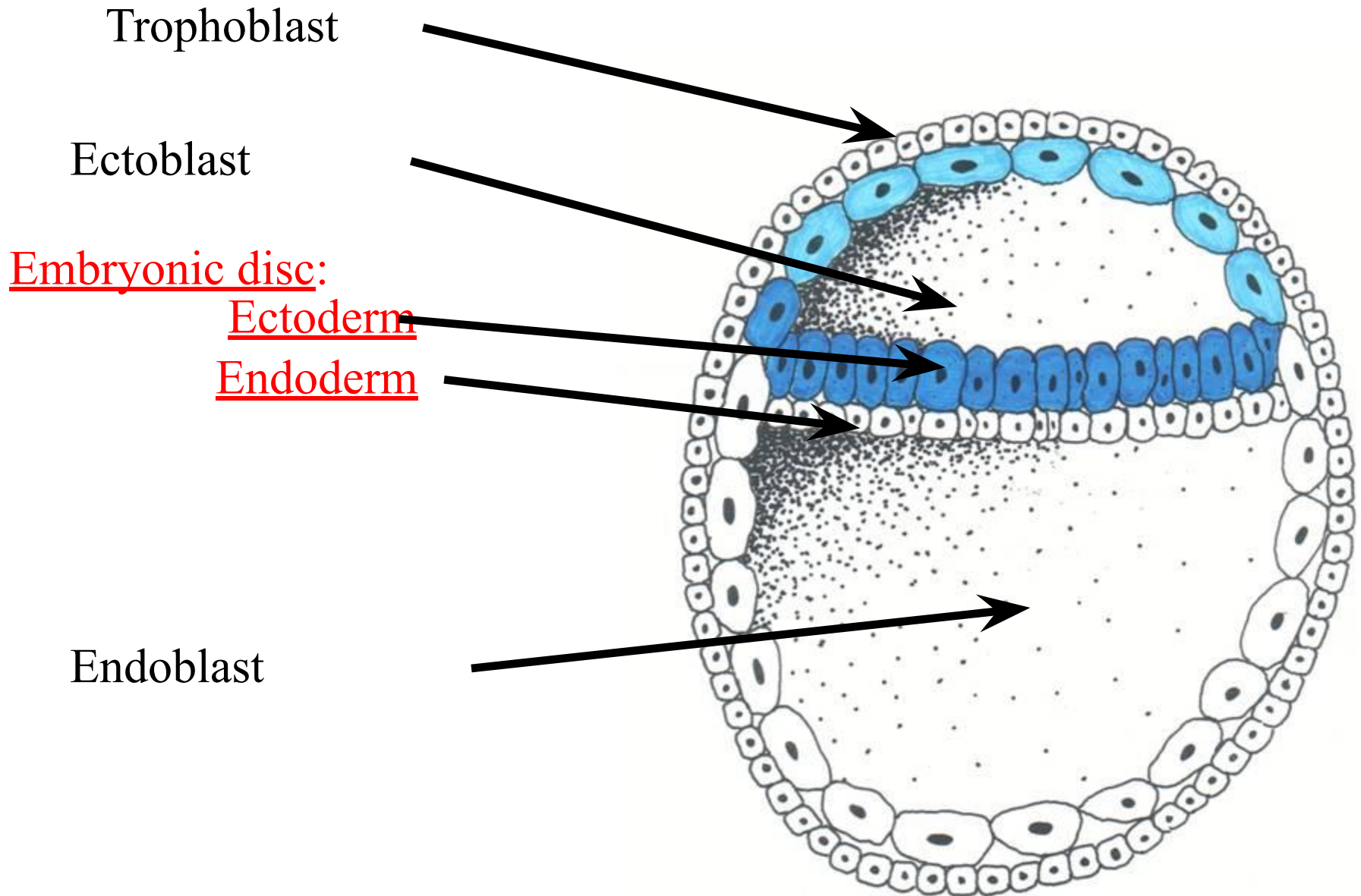


Week 2:
Beginning of

3. Gastrulation – formation of 3 germ layers

Early Gastrulation take place by delamination, when embryoblast divides into two germ layers - ectoderm and endoderm, forming *embryonic disc* and two sacs – ectoblast and endoblast

Result of early Delamination



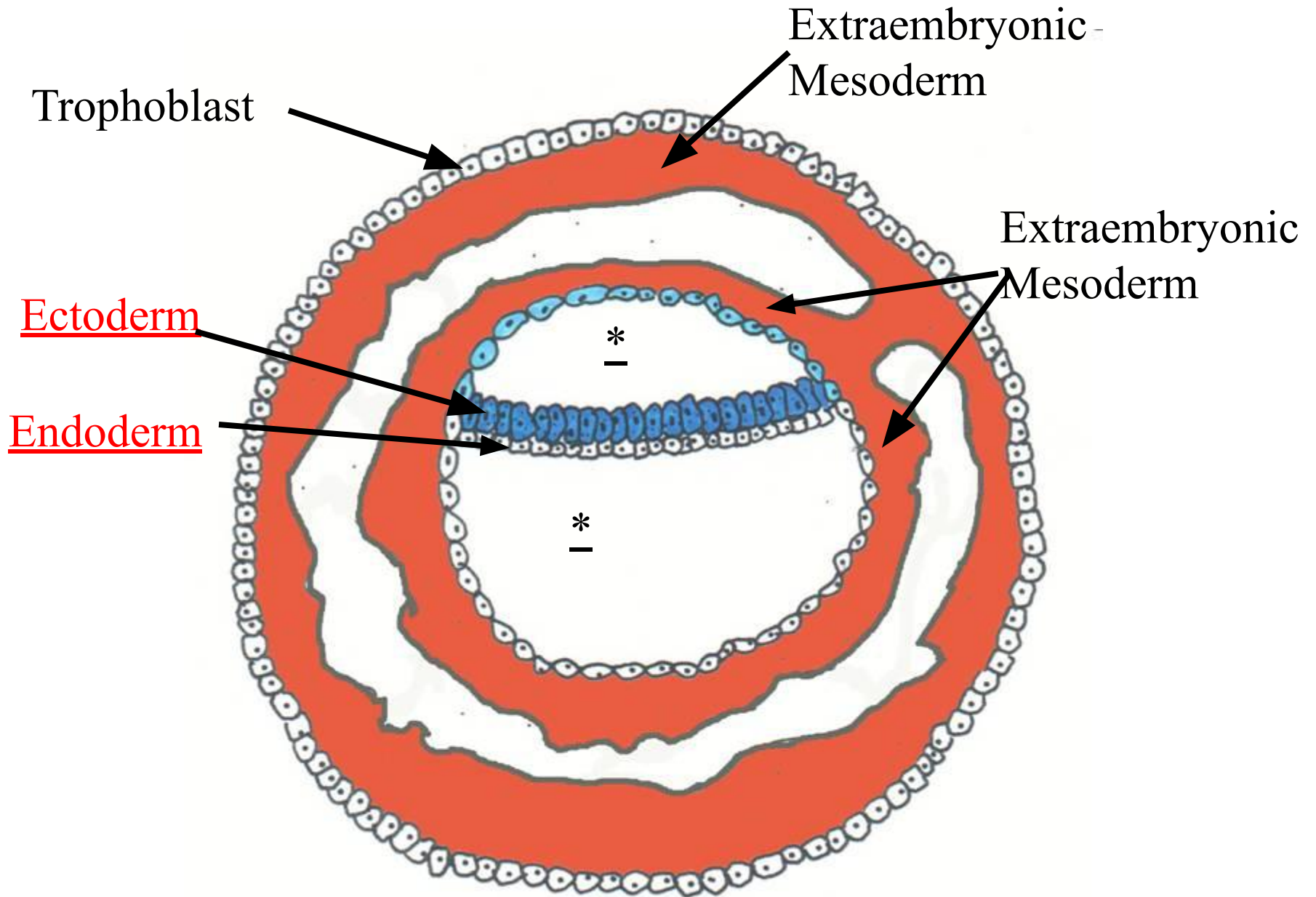
Late gastrulation – formation of
mesoderm – 3-d germ layer – take
place by cell migration:

cells which form mesoderm begin to
migrate from embryonic disc.

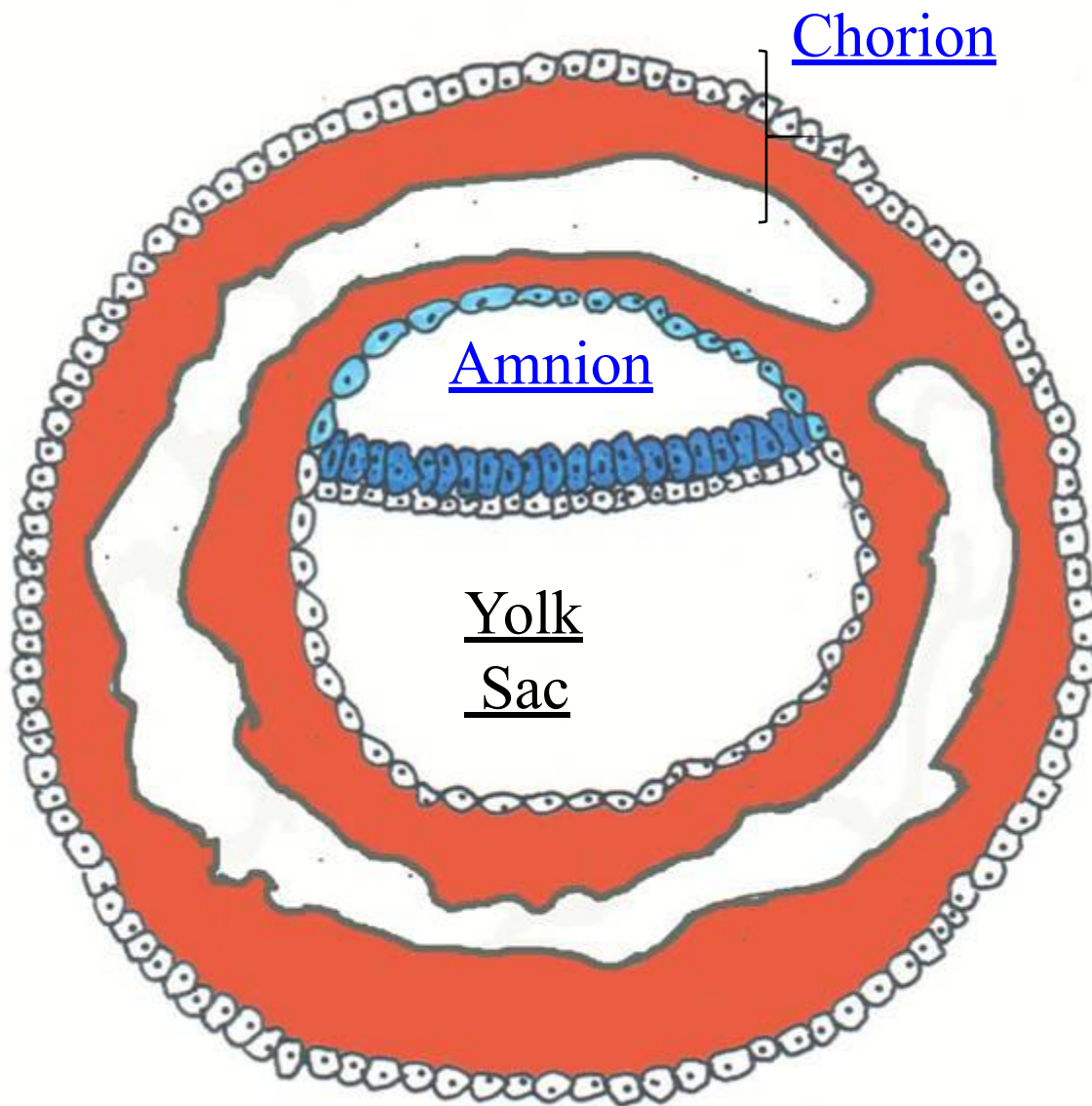
Mesoderm may be
extraembryonic and embryonic.

1-st appear *extraembryonic mesoderm*:

it surrounds upper and lower sacs,
and underly trophoblast



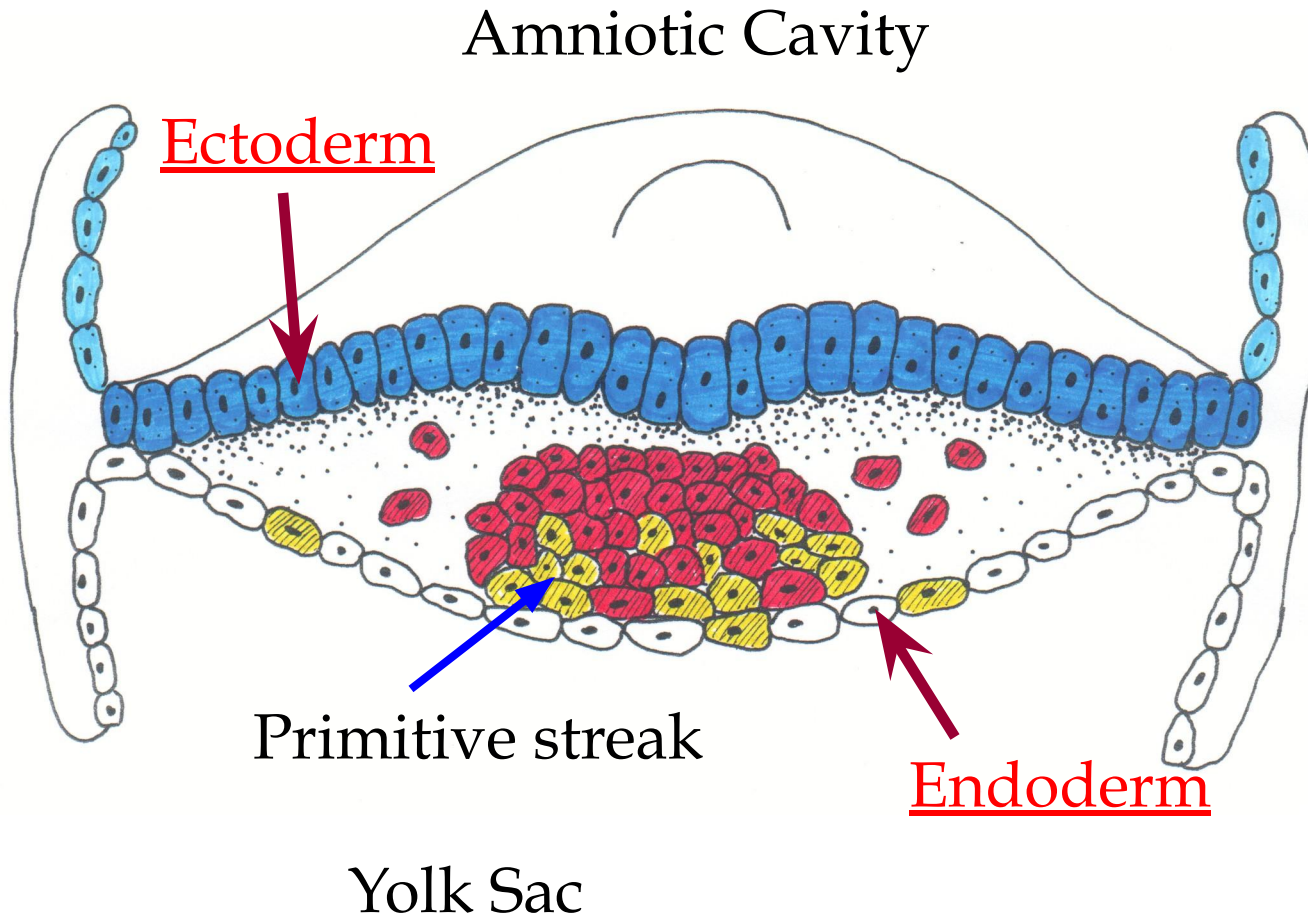
As a result appear so-called
extraembryonic organs -
amnion, yolk sac and chorion



Migration of cells within the embryonic
disc leads to formation of the
embryonic mesoderm
and axial organs
(neural tube, notochord and somites)

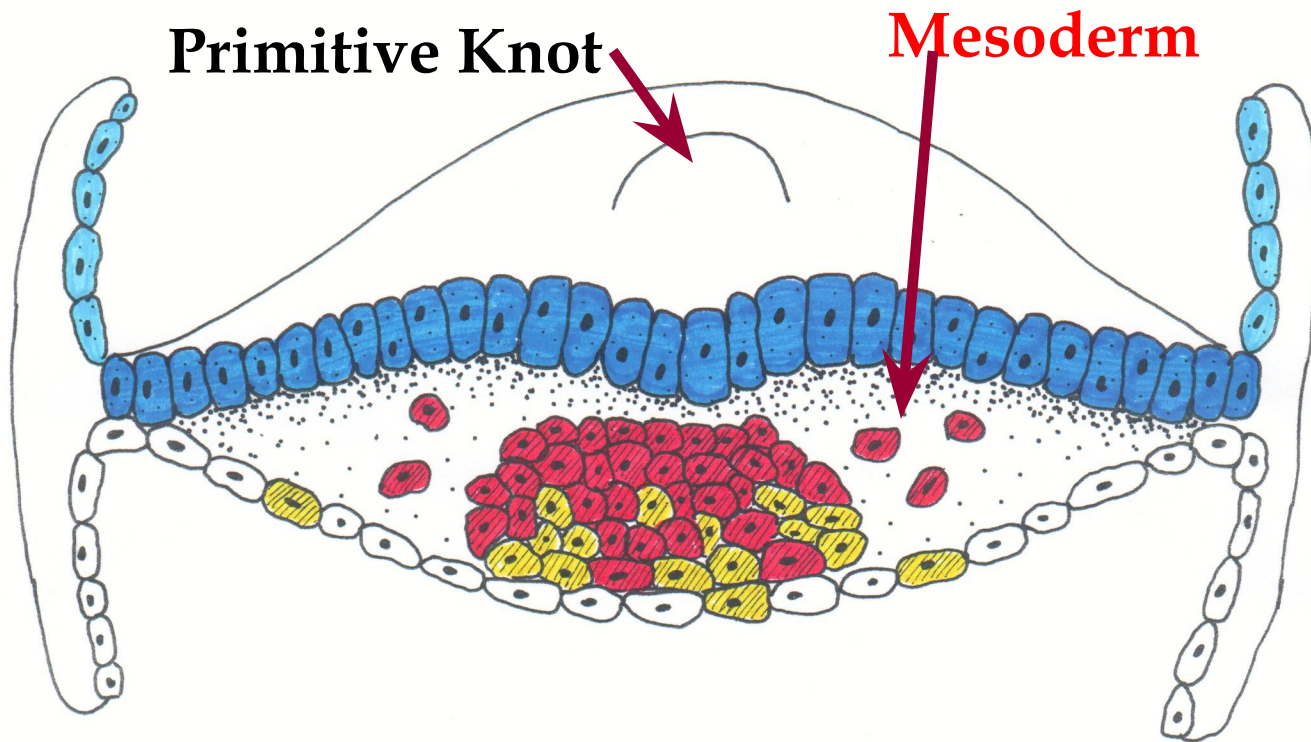
- Migration of cells within embryonic disc leads to formation of temporal cellular assemblage between ectoderm and endoderm at the caudal end of embryonic disc.
- It is a primitive streak.

Transverse section



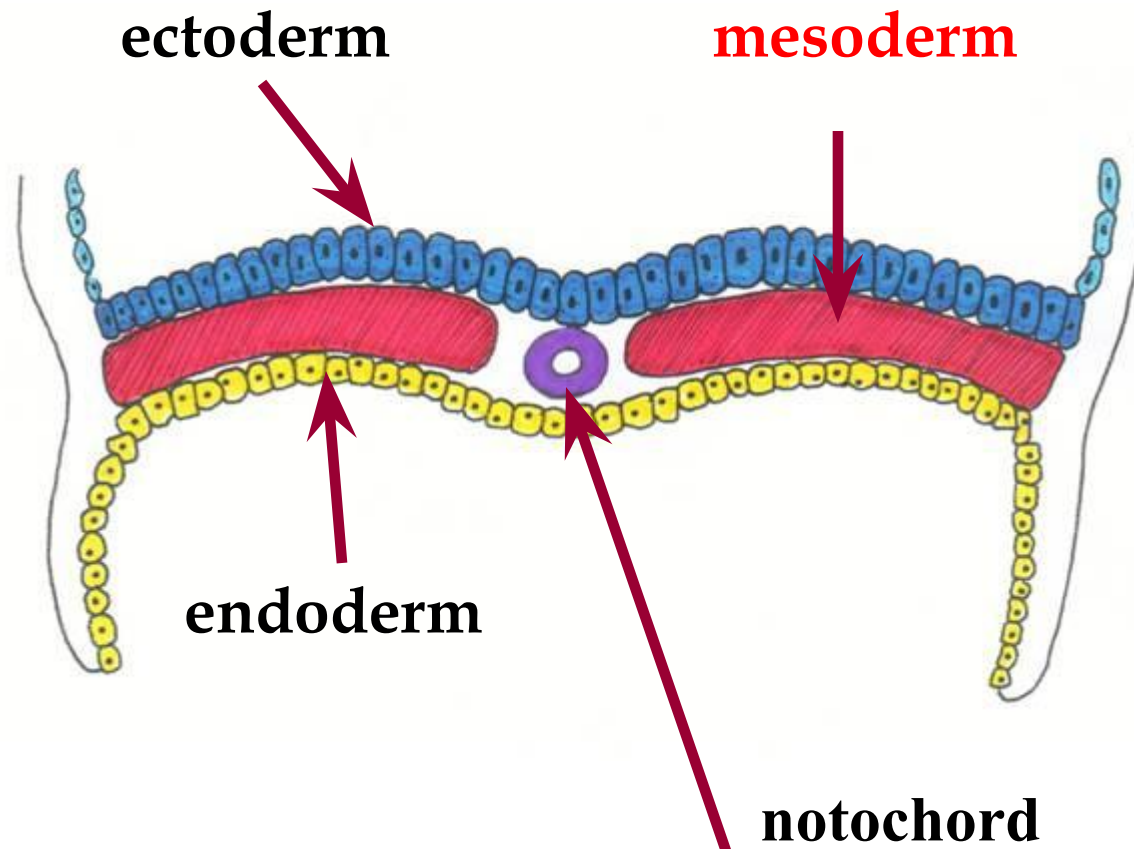
In front of primitive streak appears **primitive knot**.

Cells of Primitive Streak begin to move laterally.



Notochord appears by the primitive knot invagination.

Mesoderm appears by migration of cells from primitive streak and notochord



3-2.(next step):

Development of the

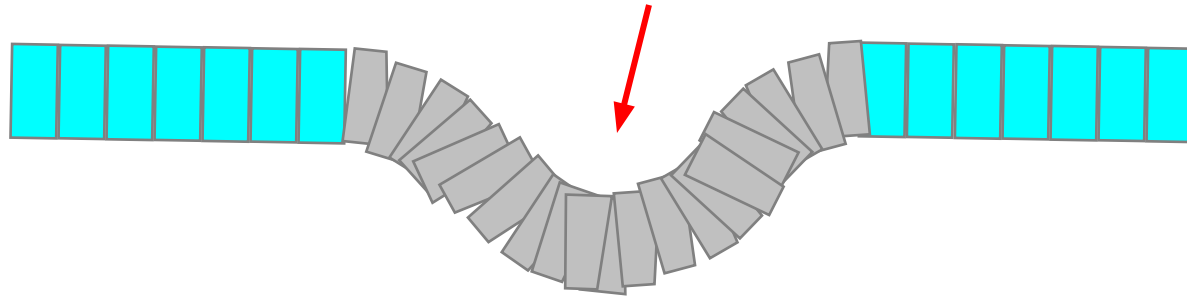
Neural Tube

- future nerve system - by the invagination of ectoderm:

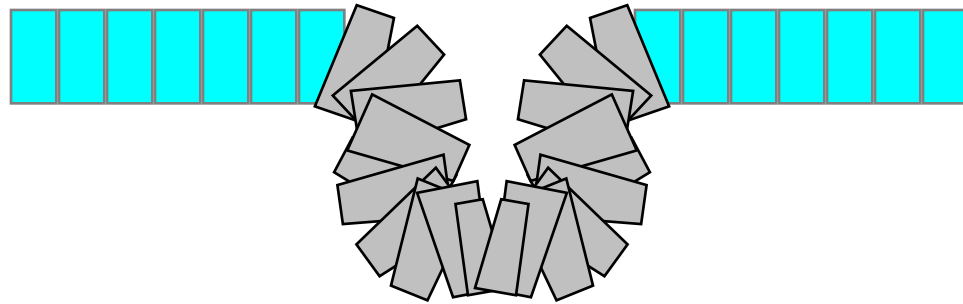


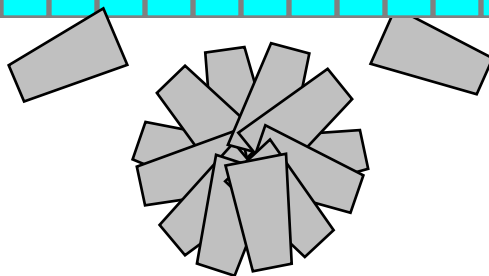
Neural plate in Surface Ectoderm forms

Neural groove

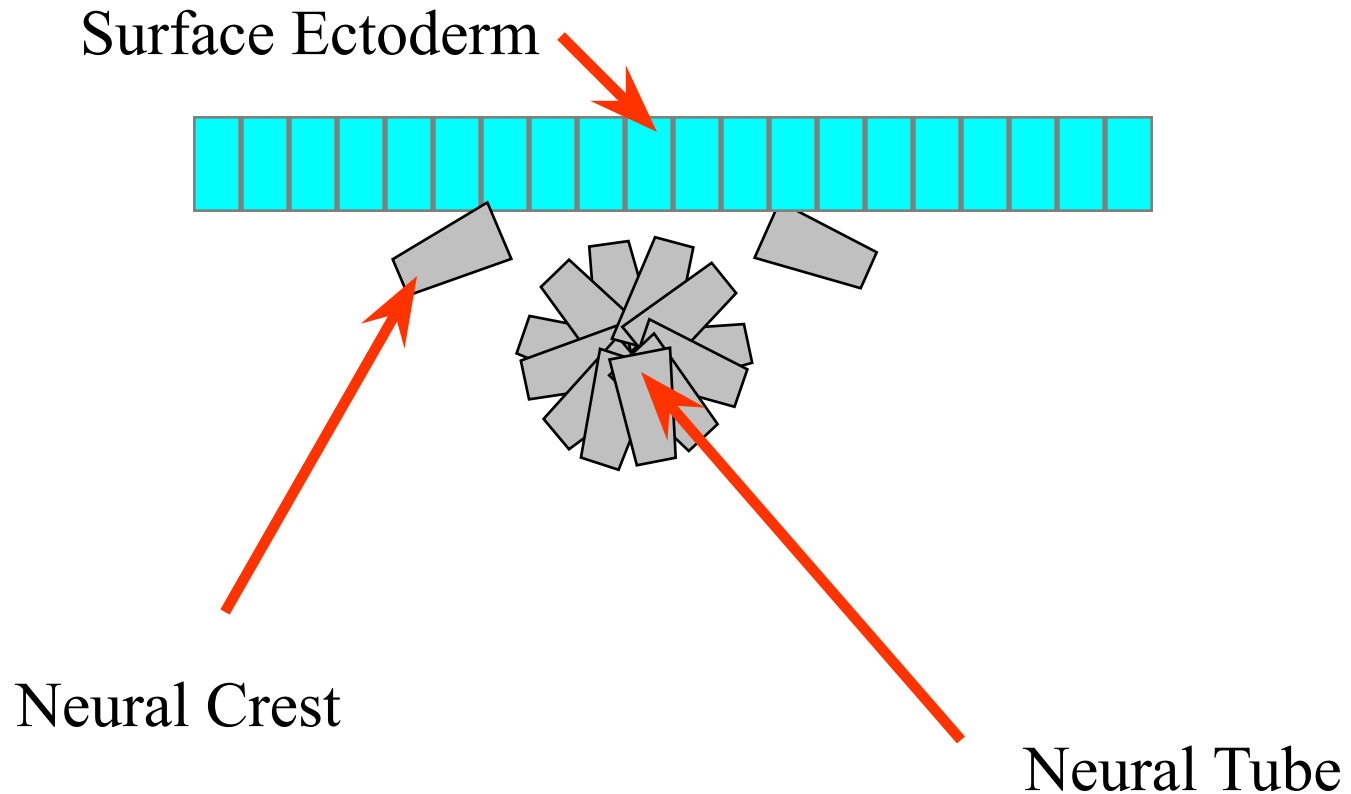


Then - Neural Tube

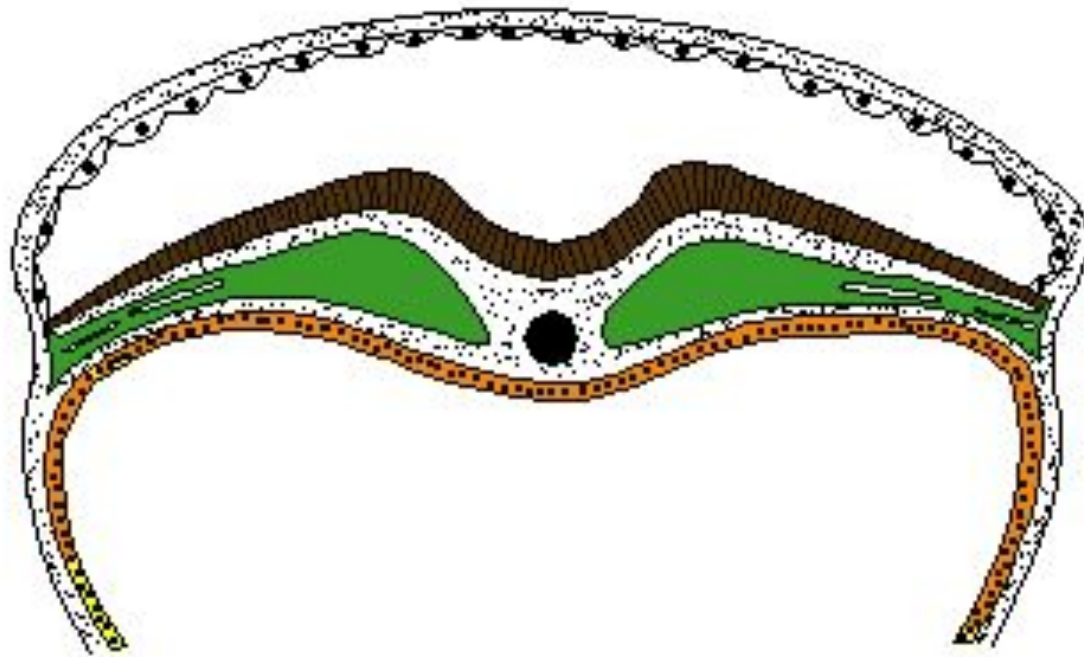




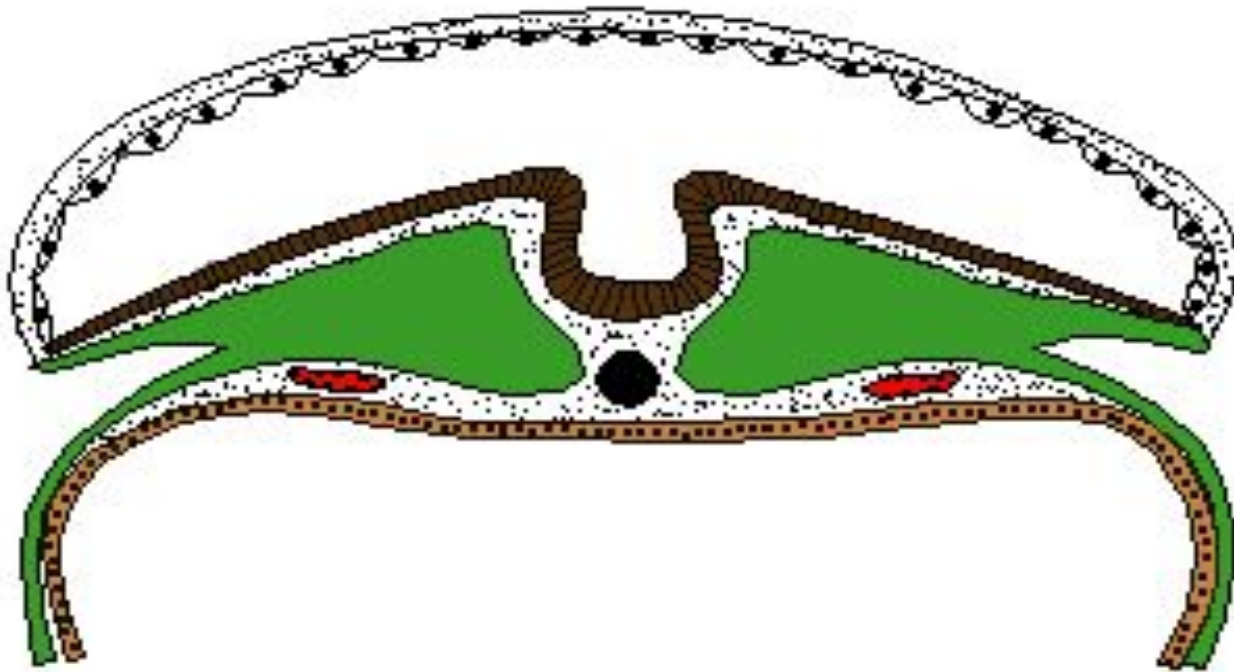
Development of the Neural Tube



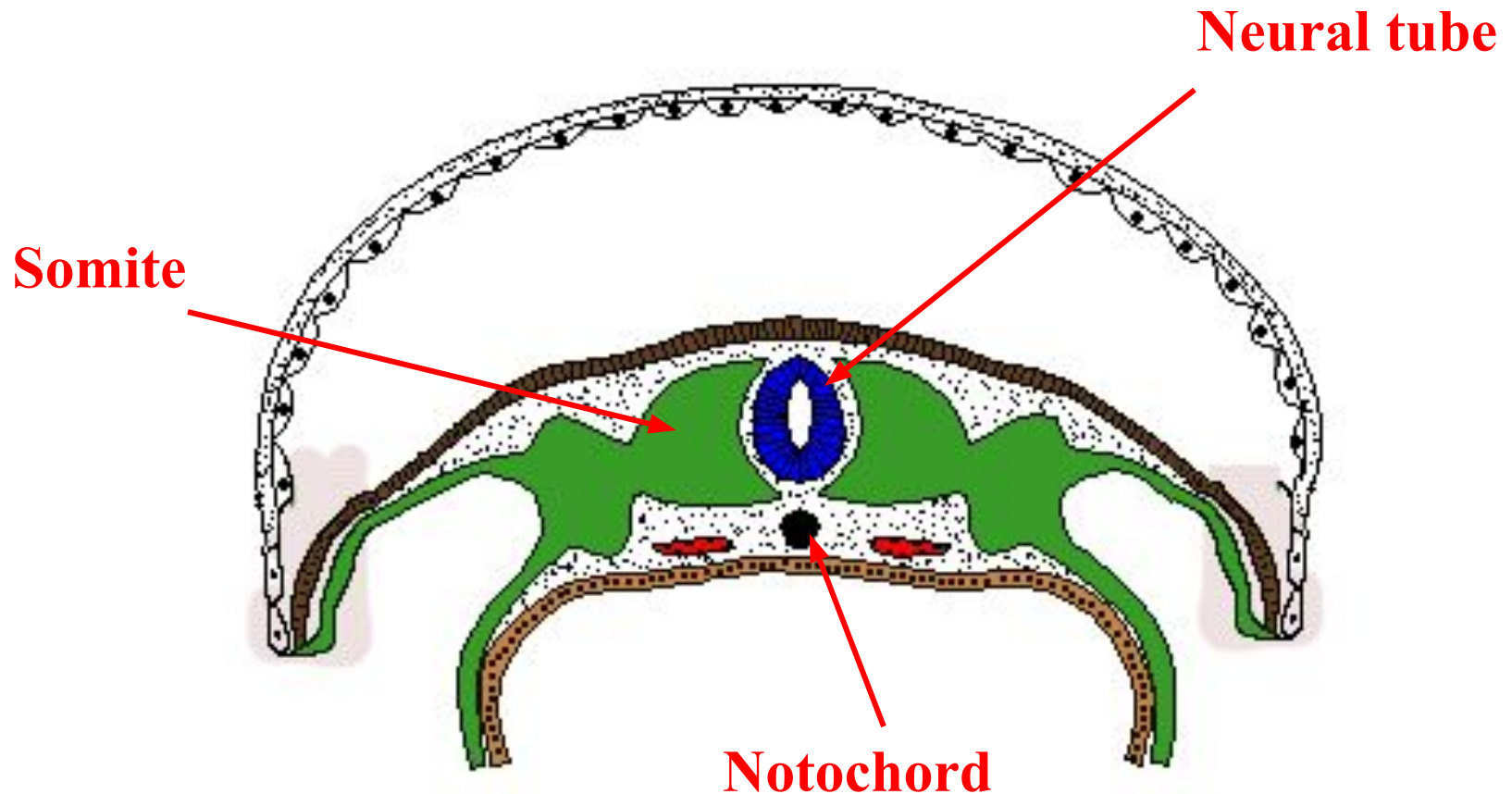
Neural tube formation



Neural tube formation



Gastrulation is finished with the formation of axial organs – **neural tube**, **notochord**, **somites (mesoderm)**



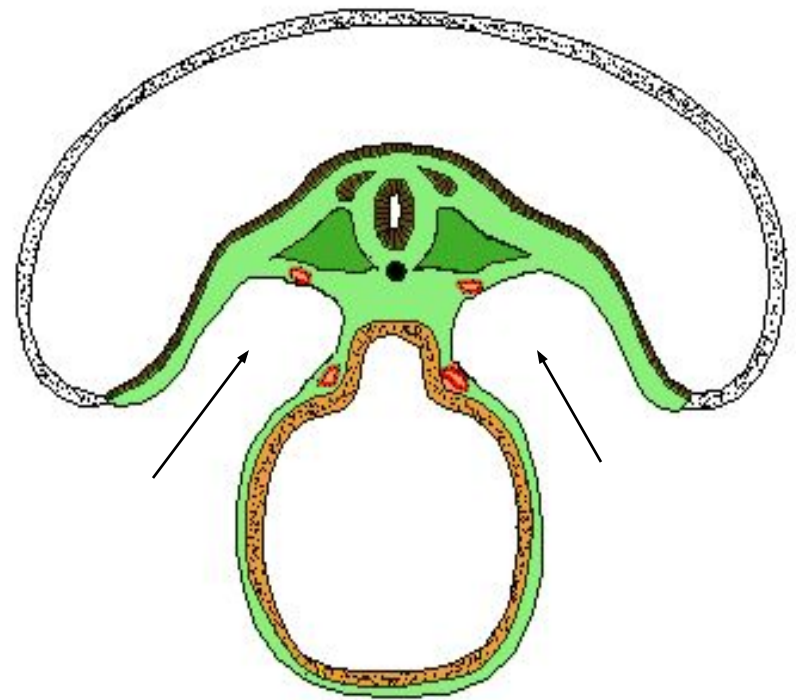
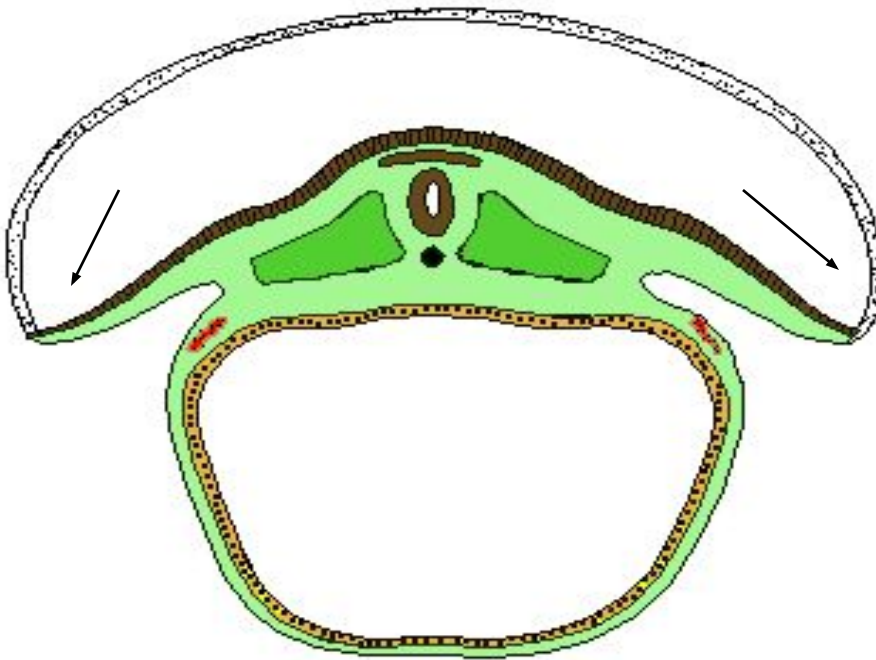
4. Formation of the embryo body

(20-th day) by:

- body flexion,
- head and tail folds formation.

Result: separation of embryonic organs from extra-embryonic organs

Body flexion



Differentiation of GERM LAYERS:

1. Differentiation of Ectoderm
 - A. Surface Ectoderm
 - B. Neural Tube
2. Differentiation of Endoderm
 - A. G.I. Tract
 - B. Respiratory Tree
 - C. Endocrine glands
3. Differentiation of Mesoderm
 - A. Somites (have 3 part - dermatome, myotome, sclerotome)
 - B. Intermediate mesoderm - nephrotome
 - C. Lateral mesoderm -splanchnotome
 - D. Mesenchyme

Differentiation of GERM LAYERS:

Surface Ectoderm differentiates to
epithelium of skin, and its derivatives,
oral cavity epithelium,
rectal epithelium,
outer corneal epithelium, tooth enamel

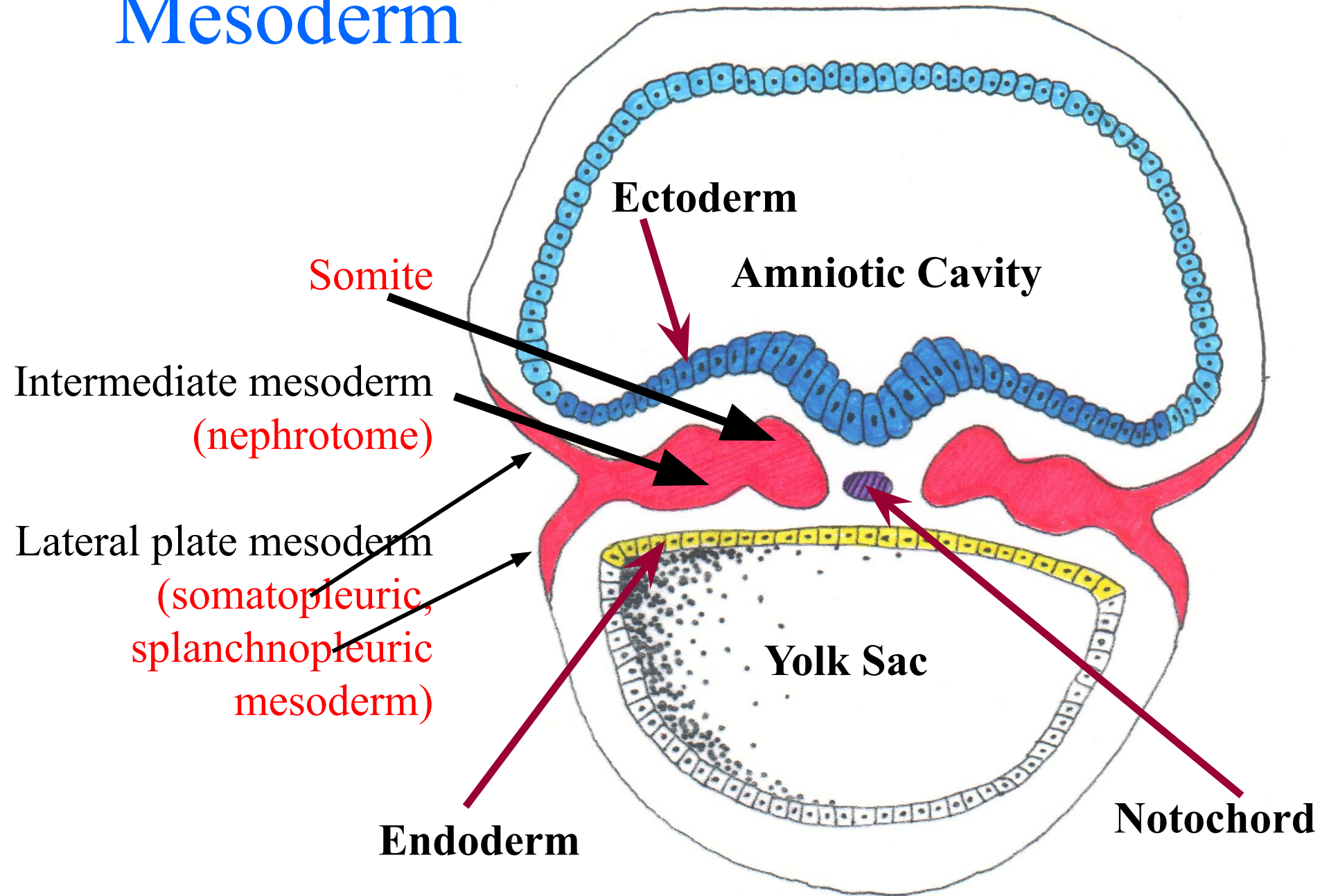
Neural tube (neuroectoderm)

--- brain, spinal cord, and the retina

Neural crests --- Peripheral Nervous system,
adrenal medulla, melanocytes of skin,
APUD-system).

Endoderm differentiates to epithelium
of stomach, intestine, liver, pancreas,
respiratory system

Mesoderm



Mesoderm

Somite

dermatome - dermis
of skin
myotome - muscles,
sclerotome -
skeleton

Nephrotome

urogenital system
including kidneys, gonads,
ducts, and accessory glands

Lateral Mesoderm

-

serous membranes of pleura,
pericardium and peritoneum

Mesenchyme (loose part) –
connective tissue, smooth
muscle tissue, blood and
lymph cells, cardiovascular
and lymphatic systems

Late embryonic stages

- Histogenesis
- Organogenesis

Summary:

Week 1-3:

Early Stages:

- 1. Fertilization – Zygote formation
- 2. Cleavage – Blastocyst formation
- 3. Gastrulation – Germ layers formation

Axial organs formation

- 4. Formation of the embryo body

- Late stages:

Histogenesis, Organogenesis – **next lectures**