EARLY DEVELOPMENT AND IMPLANTATION

FOCUS ON THE FIRST TWO WEEKS AFTER FERTILIZATION

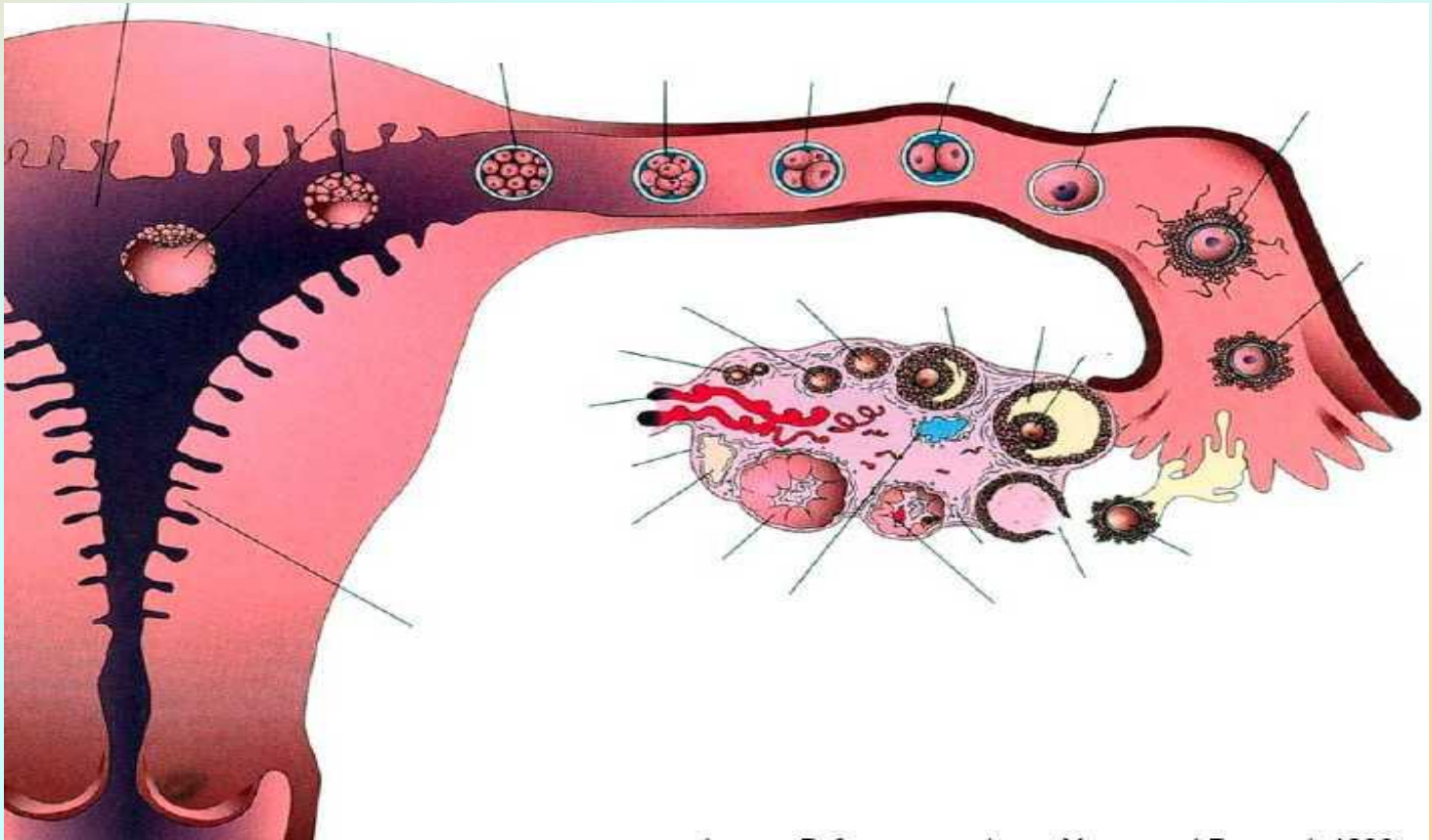
DR. BEDA OLABU

EXPECTED LEARNING OUTCOMES

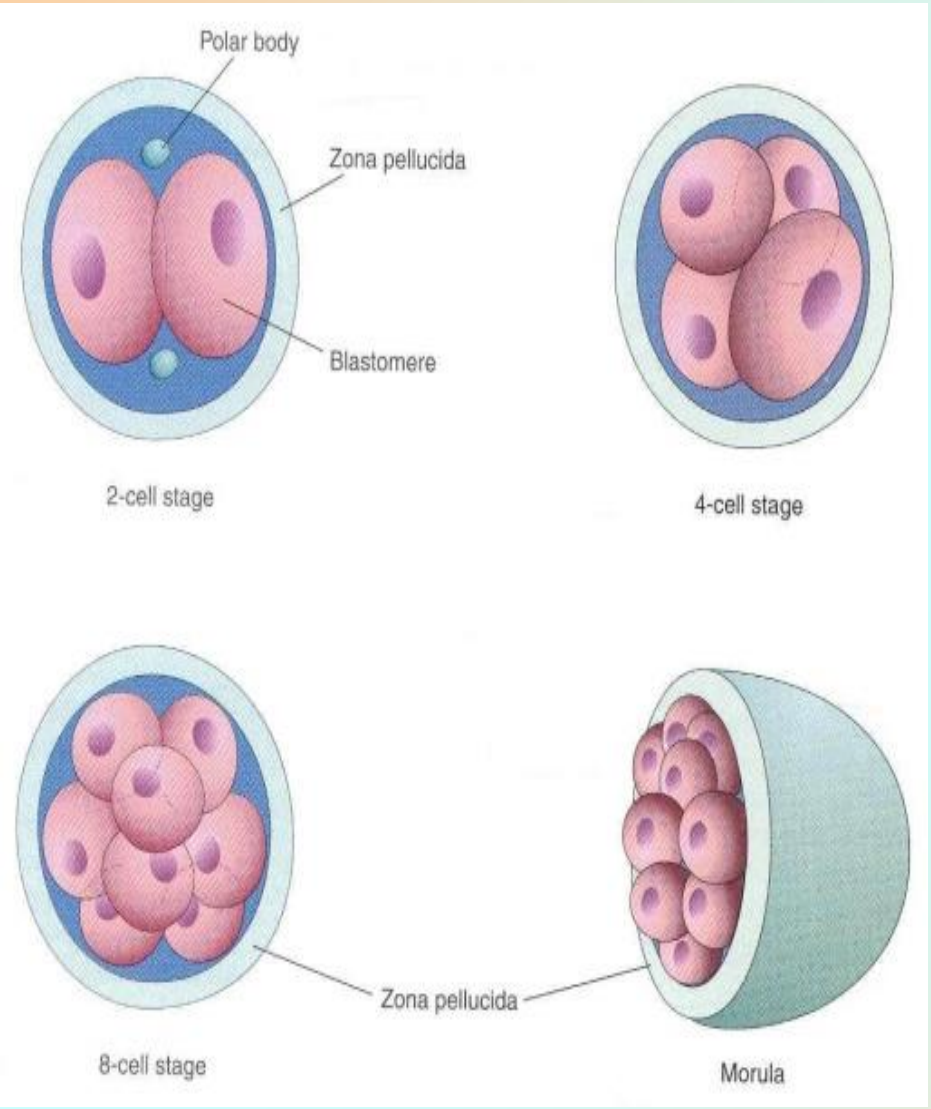
1. Outline the sequence of events that occur during the 1st week
2. Outline the sequence of events that occur, & structures that form, during the 2nd week
3. Integrate the meaning of the “week of twos”
4. Describe the process of implantation
5. Highlight on common disorders of implantation
6. Mechanisms and complications of twinning

1ST WEEK OF DEVELOPMENT

- Occurs largely within the fallopian tube (4 days) as the conceptus moves towards uterine cavity



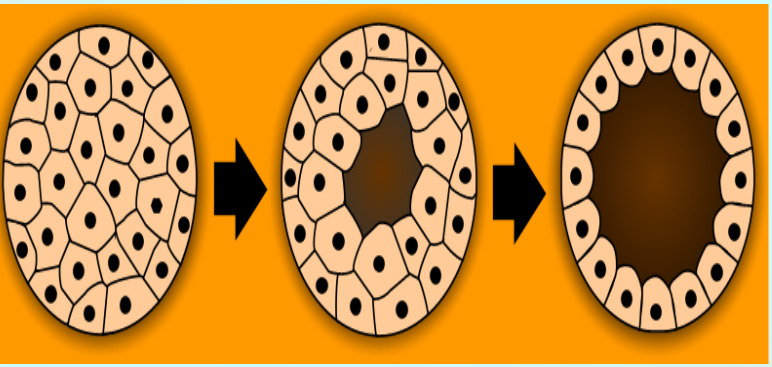
1ST WEEK OF DEVELOPMENT

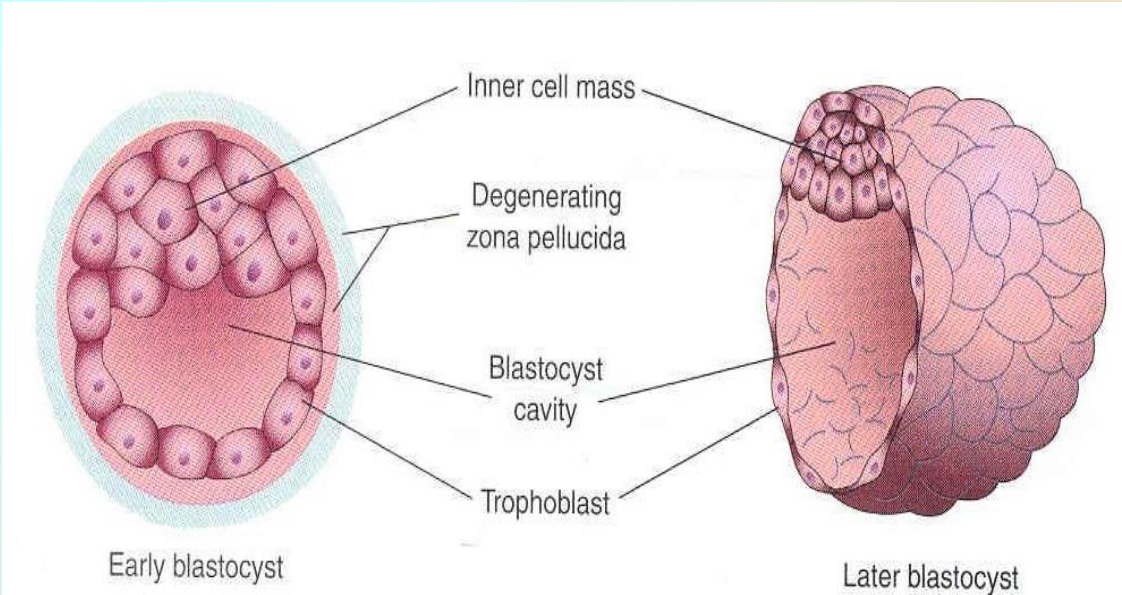


- The zygote develops by undergoing cleavage
- Individual cells are called blastomeres
- 12-32 cell stage is a morula
- Cells are compacted due to rapid increase in number, but not size (zona pellucida still intact)

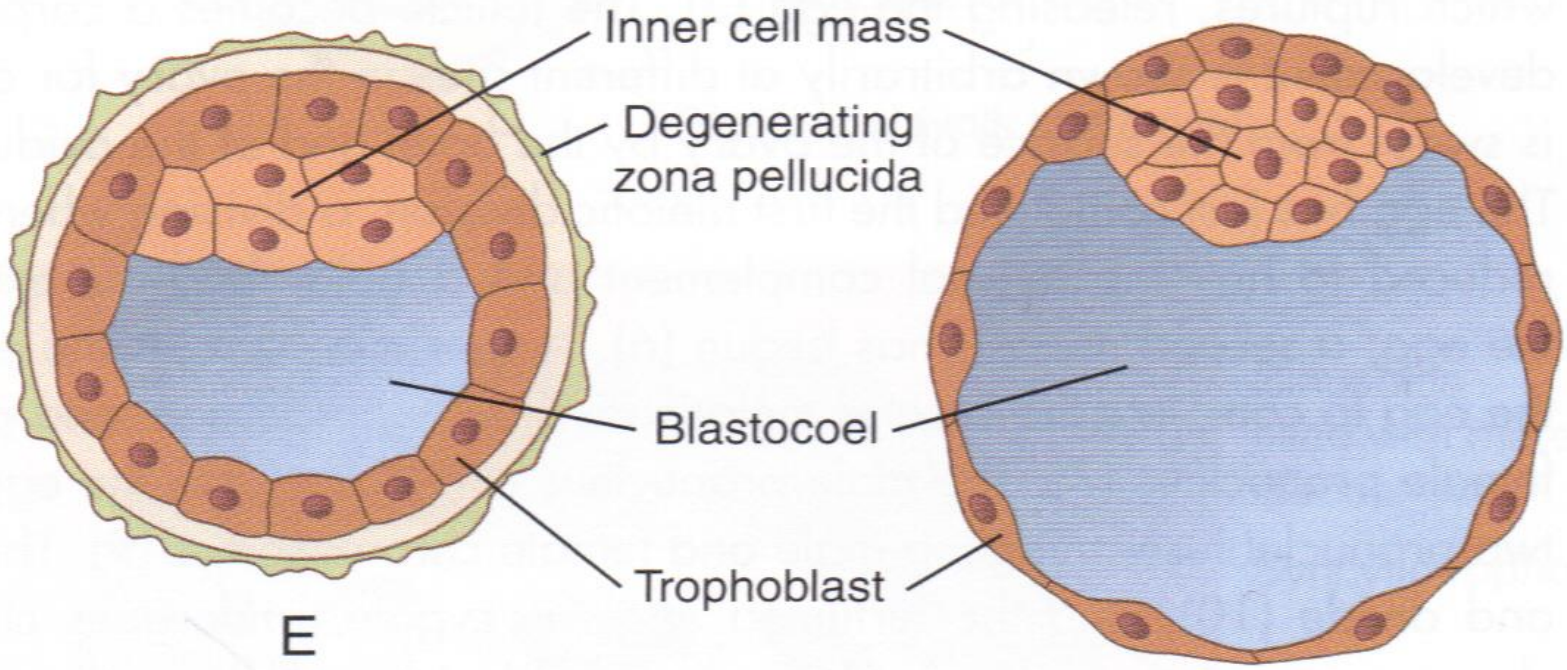
1ST WEEK OF DEVELOPMENT

- The blastomeres take up fluid into a cavity (blastocyst cavity)
- Cells reorganize into two cellular populations – inner and outer cell masses
- The resultant structure is called a blastocyst
- The zona pellucida degenerate progressively (hatching) – early and late blastocyst





PARTS OF THE BLASTOCYST



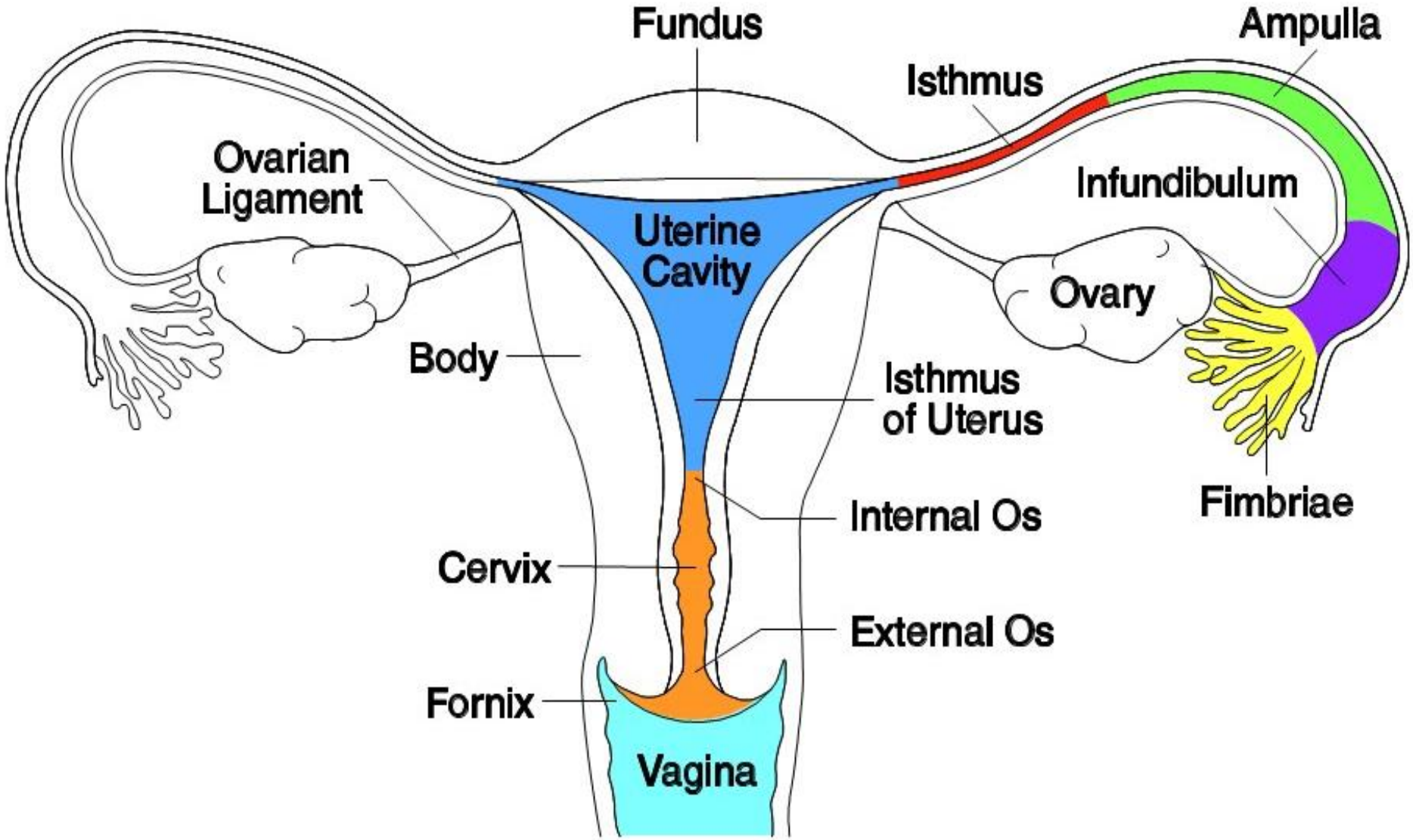
- Blastocele
- Inner cell mass – embryoblast
- Outer cell mass – trophoblast
- Embryonic pole
- Abembryonic pole

IMPLANTATION

- The process by which the developing mass gets embedded within the uterine wall (endometrium)

- Occurs between day 6-13

REVIEW OF UTERINE ANATOMY



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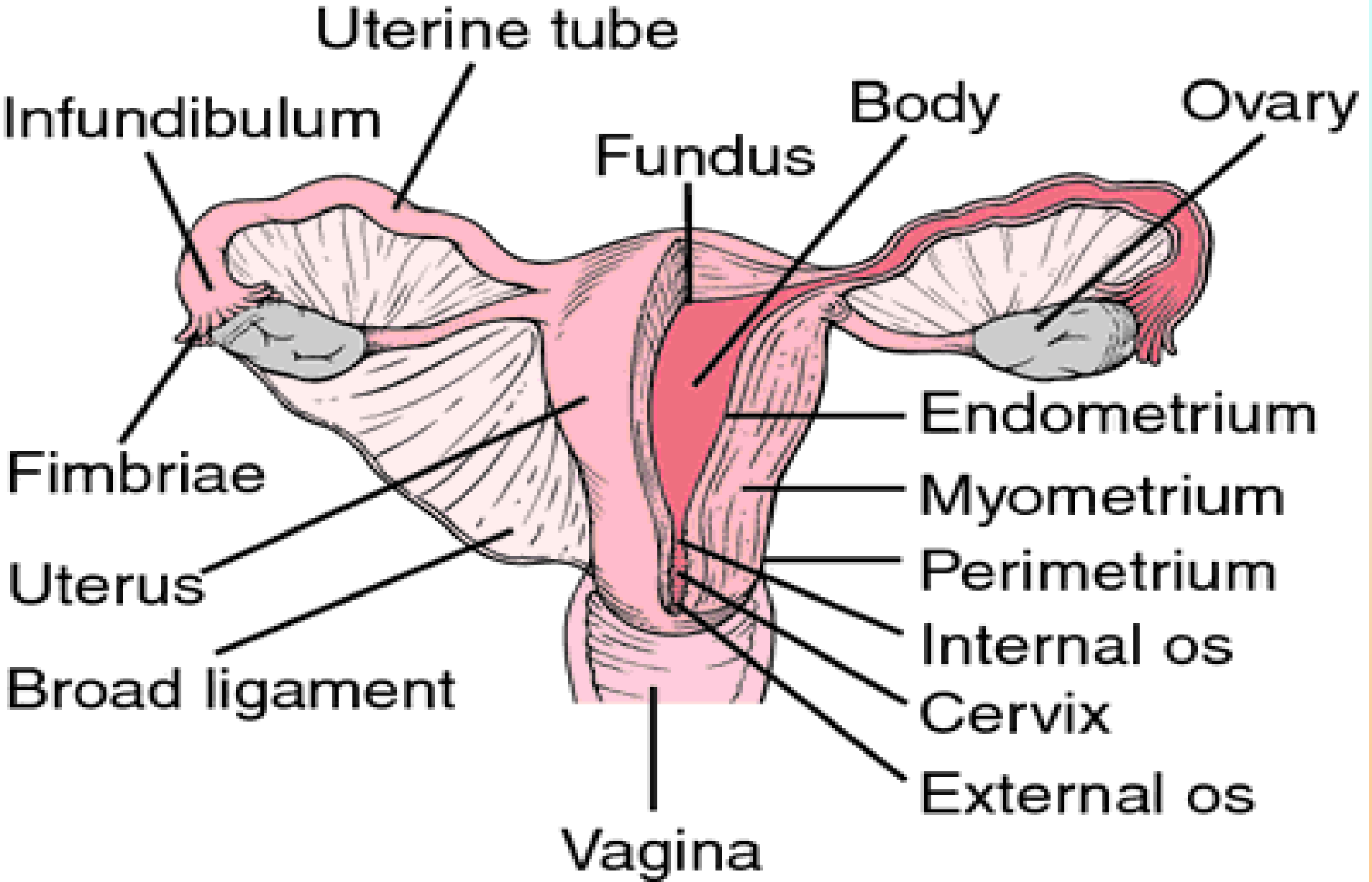

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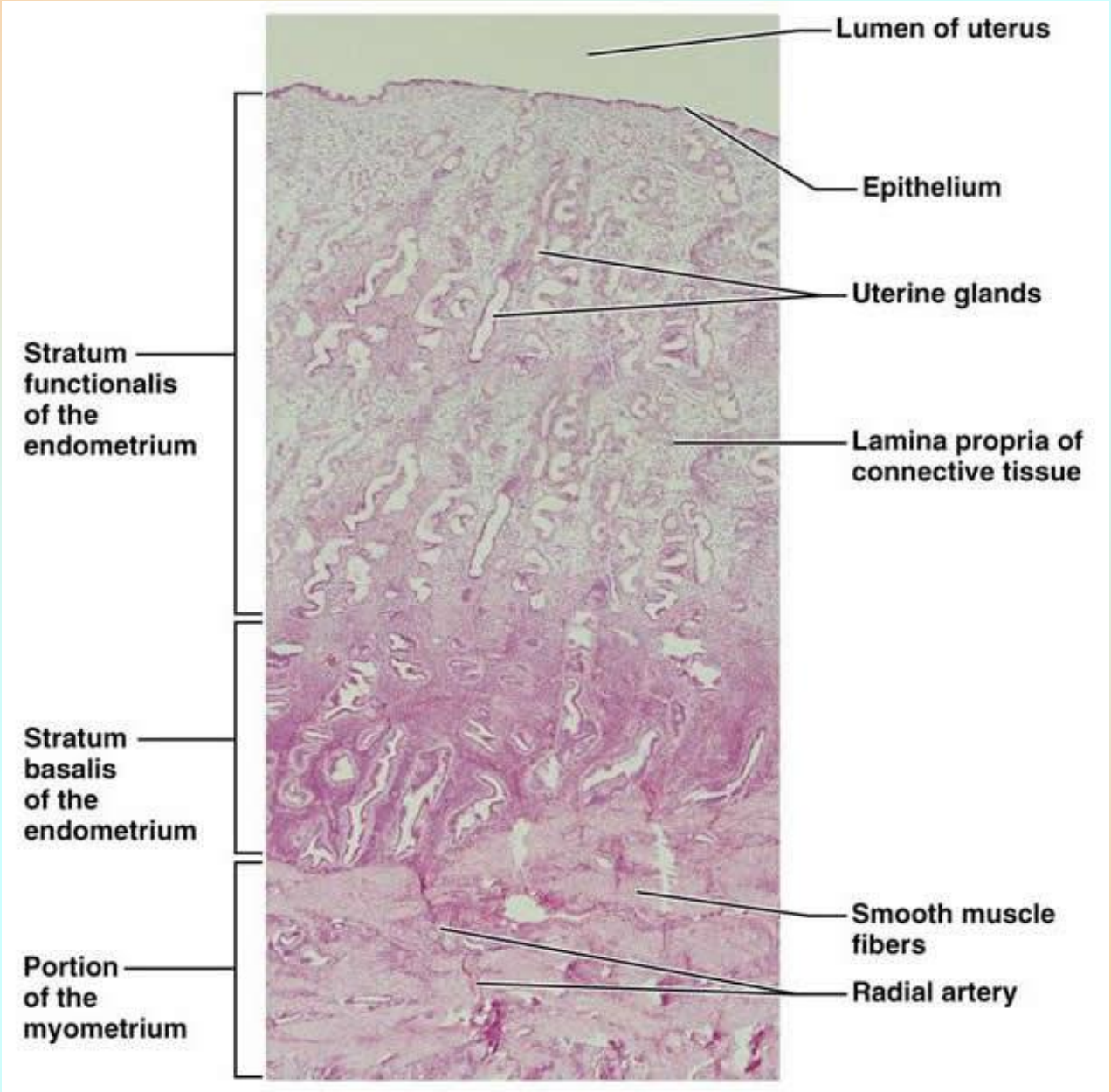
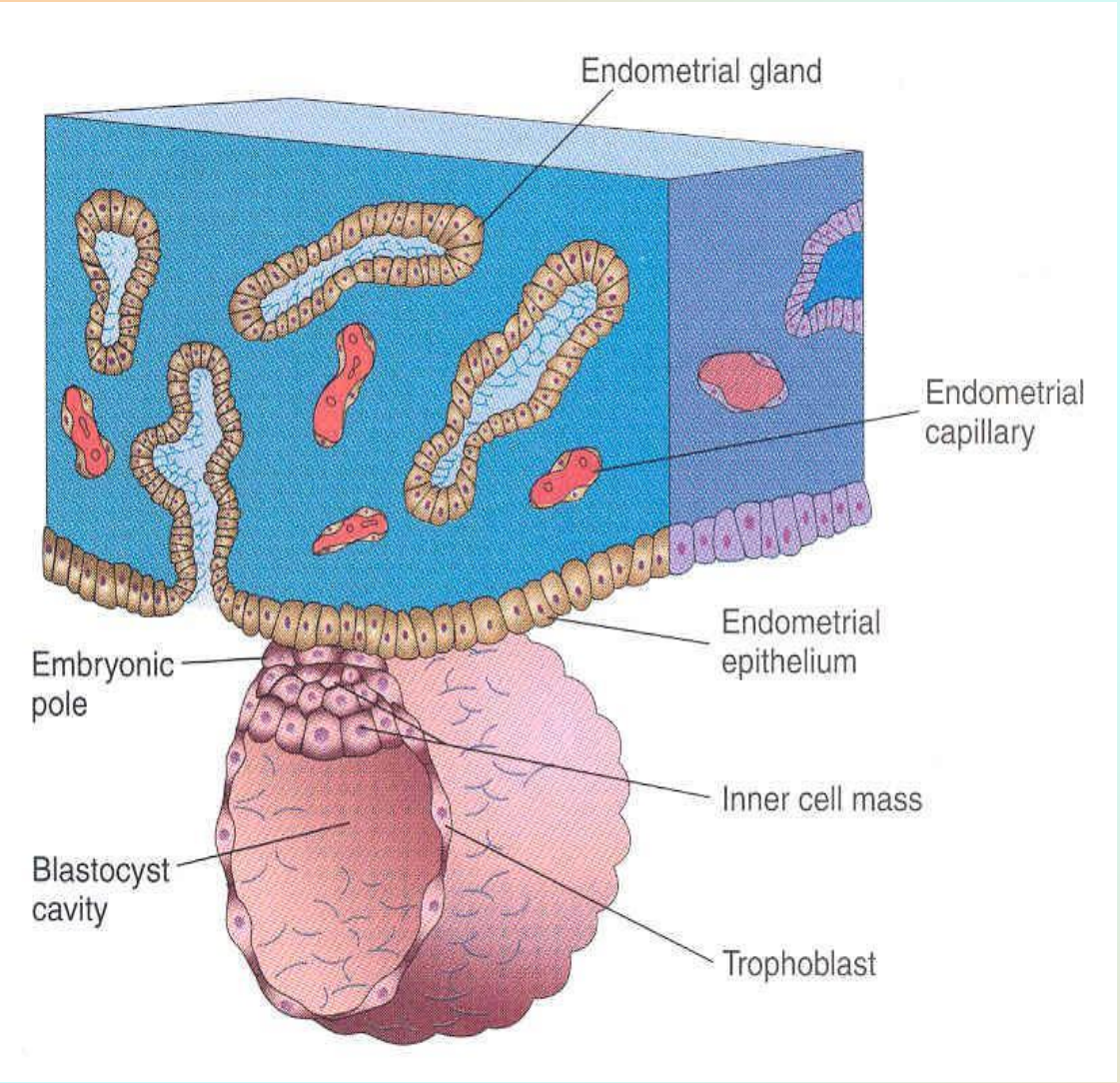


IMPLANTATION

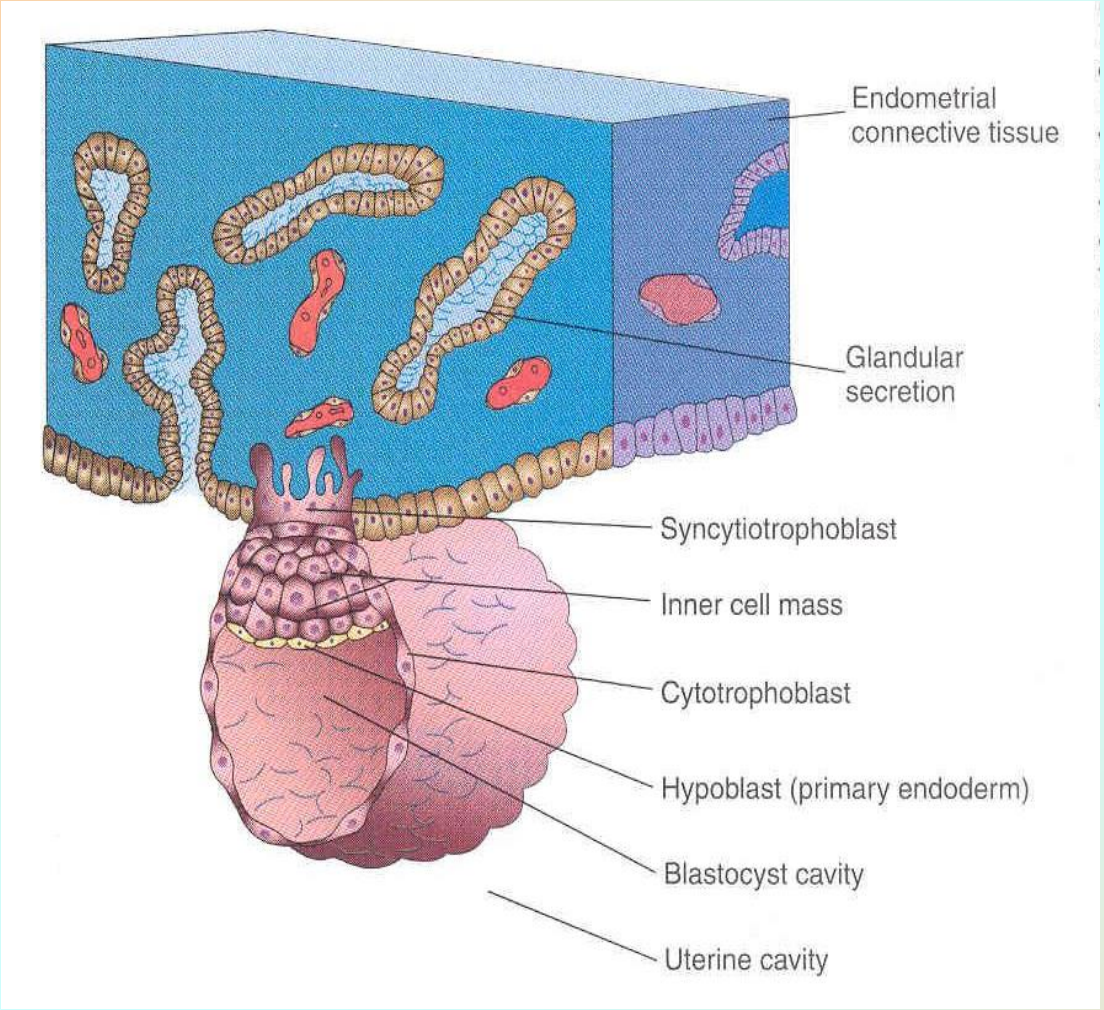
- The process by which the developing mass gets embedded within the uterine wall (endometrium)
- Begins around day 6, completed around day 12-13
- The site of implantation determines the site of formation of the placenta
- Commonly in the upper part of the body of uterus, more often on the posterior wall

IMPLANTATION



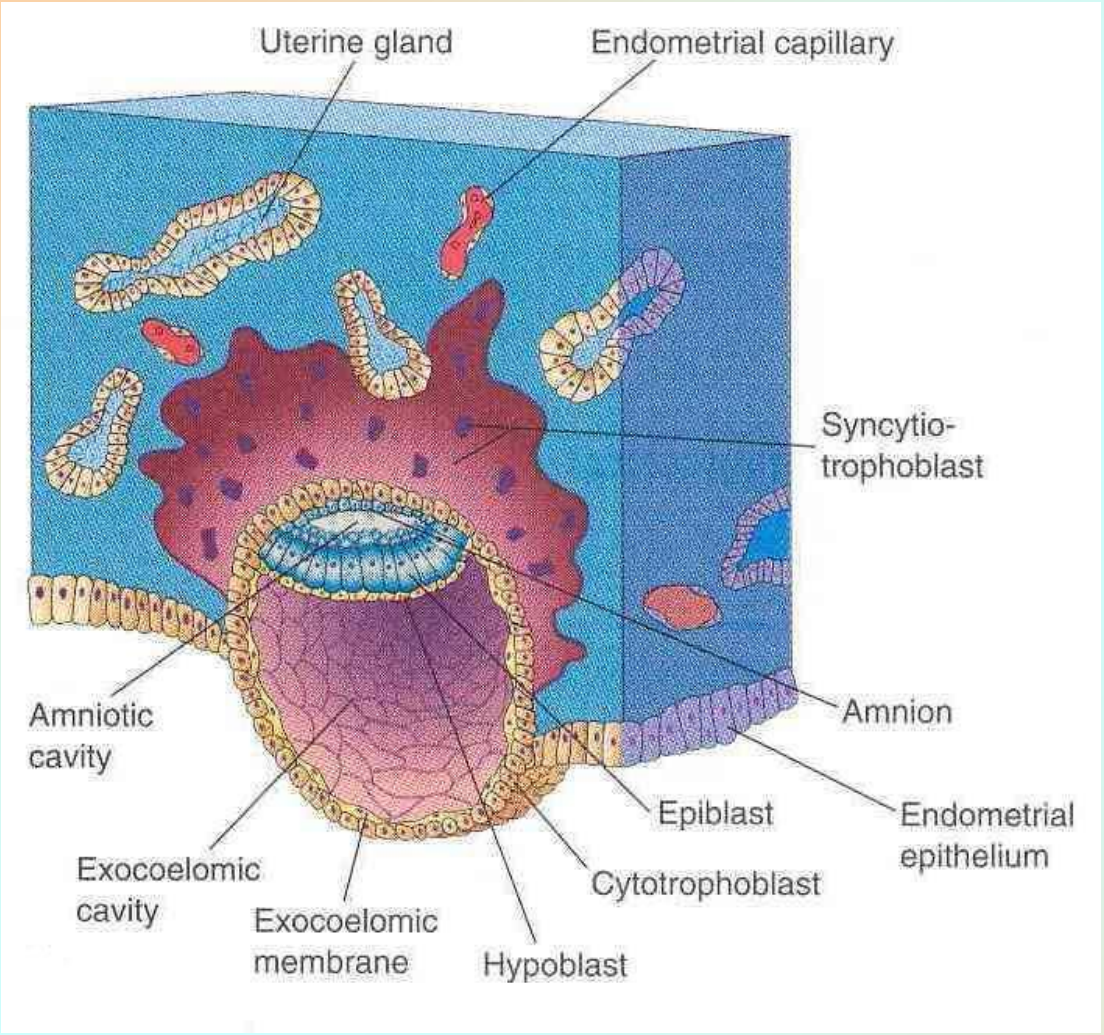
- Hatching
- Attachment

IMPLANTATION



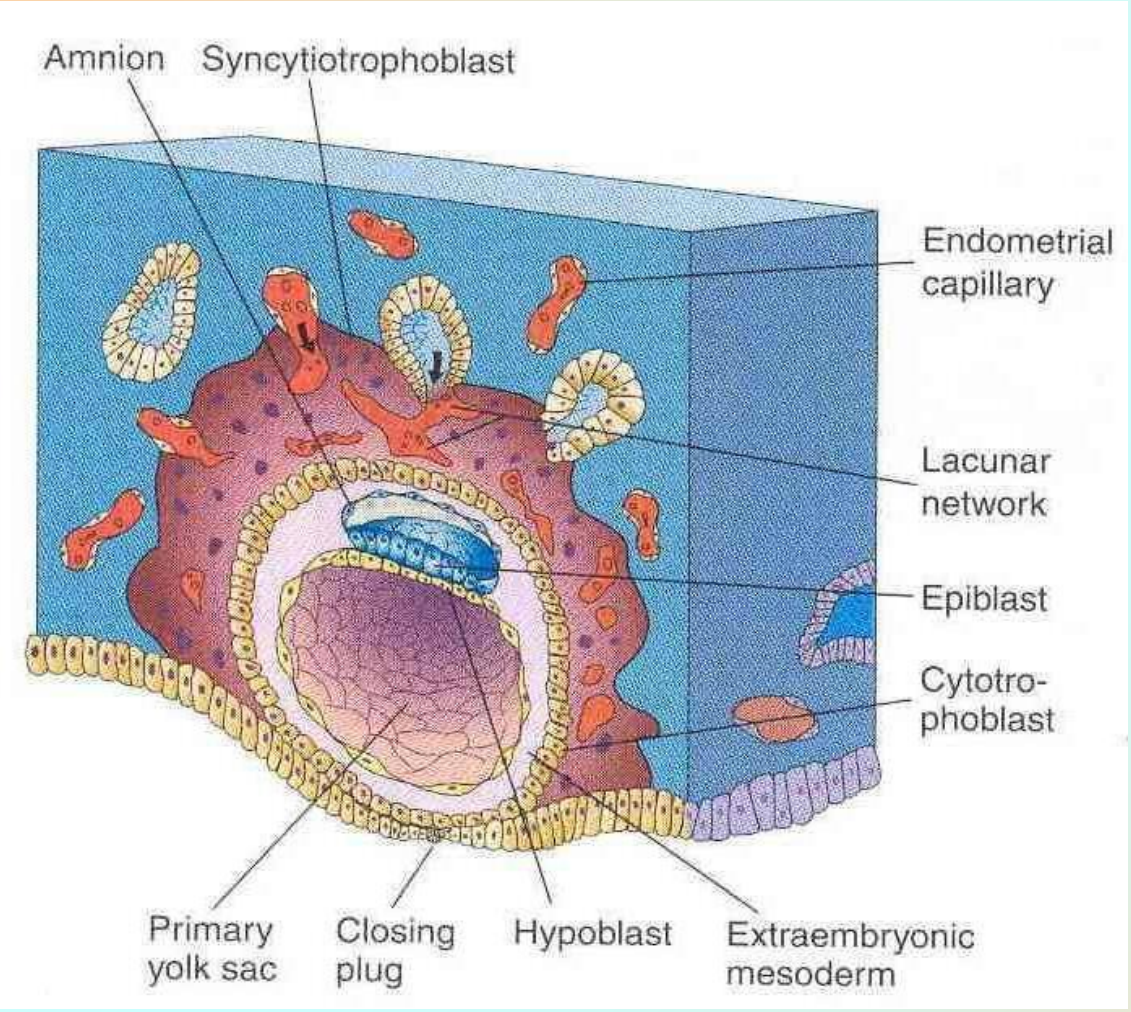
- Syncitiotrophoblast formation
- Invasion of the endometrial CT
- Gradual embedding into deeper parts of the endometrium

IMPLANTATION



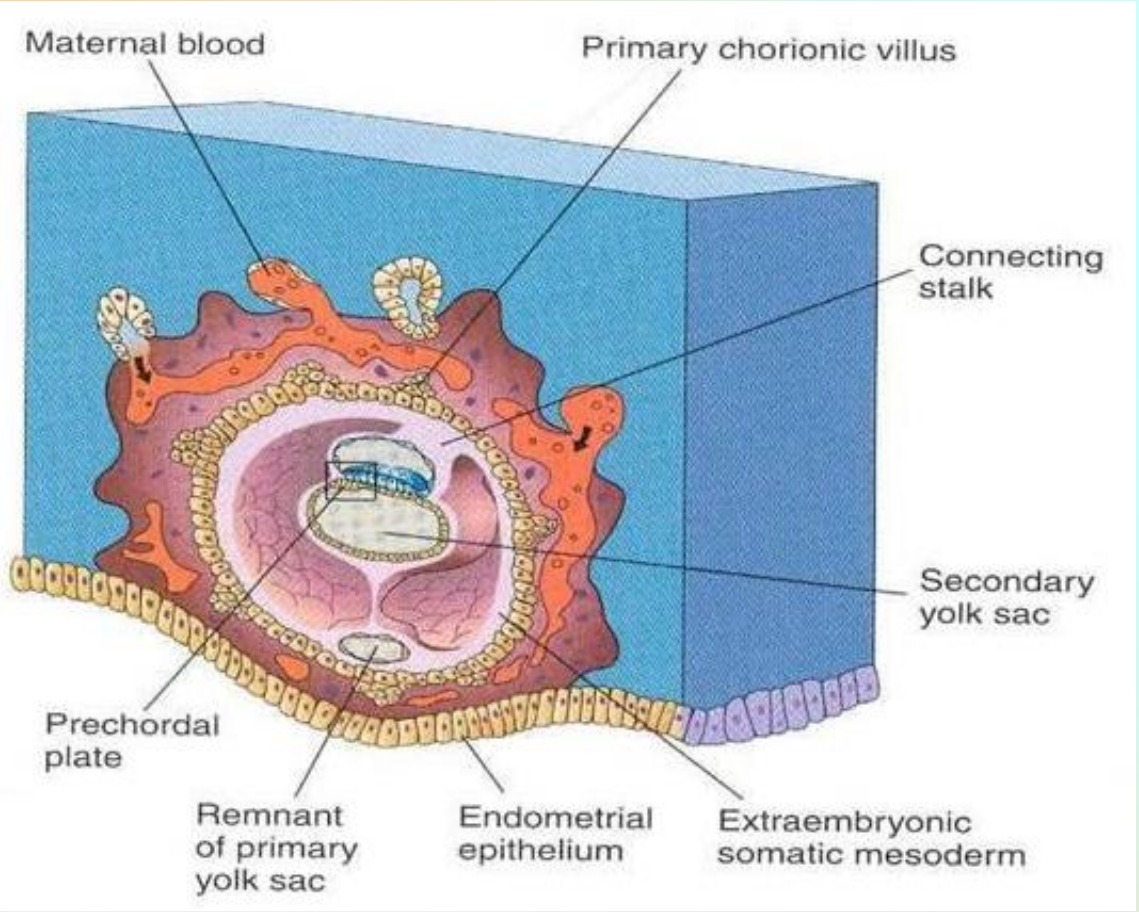
- Gradual embedding into deeper parts of the endometrium

IMPLANTATION



- Trophoblastic lacunae
- Primitive uteroplacental unit
- Closing plug fills the defect in the endometrial epithelium

IMPLANTATION

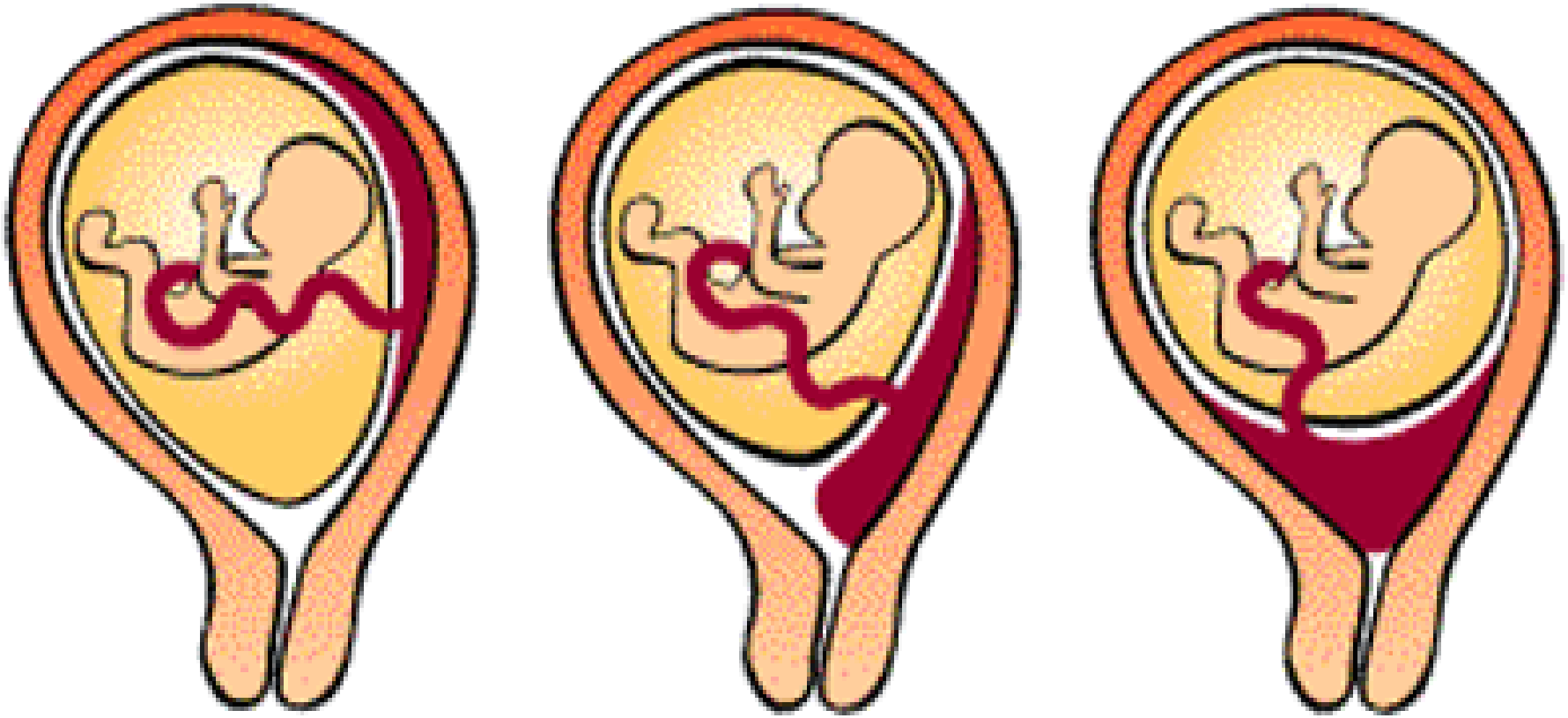


- Epithelial repair

ABNORMAL SITES OF IMPLANTATION

- The implantation site determines the site of formation of the placenta
- Normally – upper part of the body of uterus, more often on the posterior wall

PLACENTA PREVIA

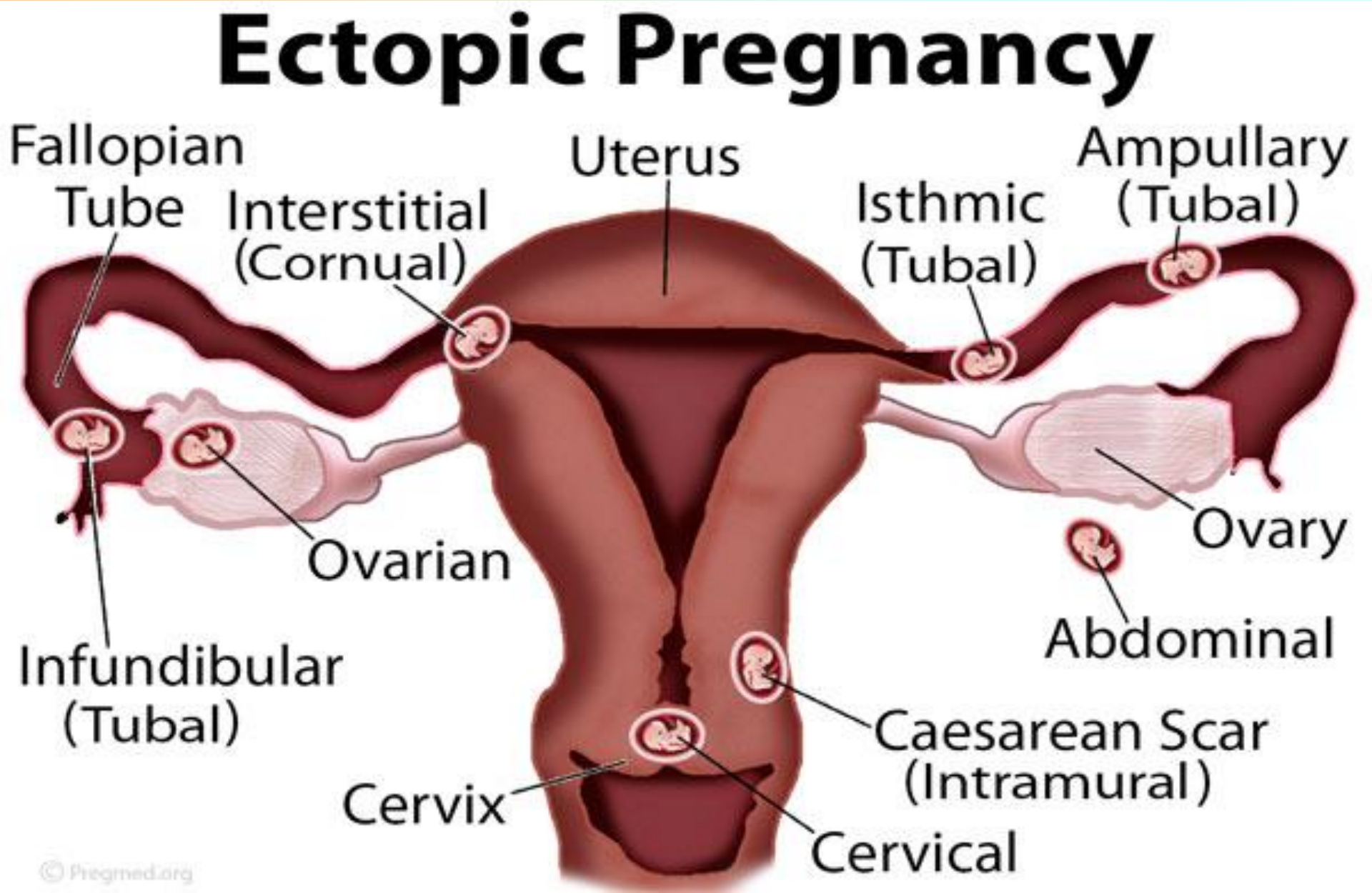


Normal Placenta

Marginal Placenta Previa

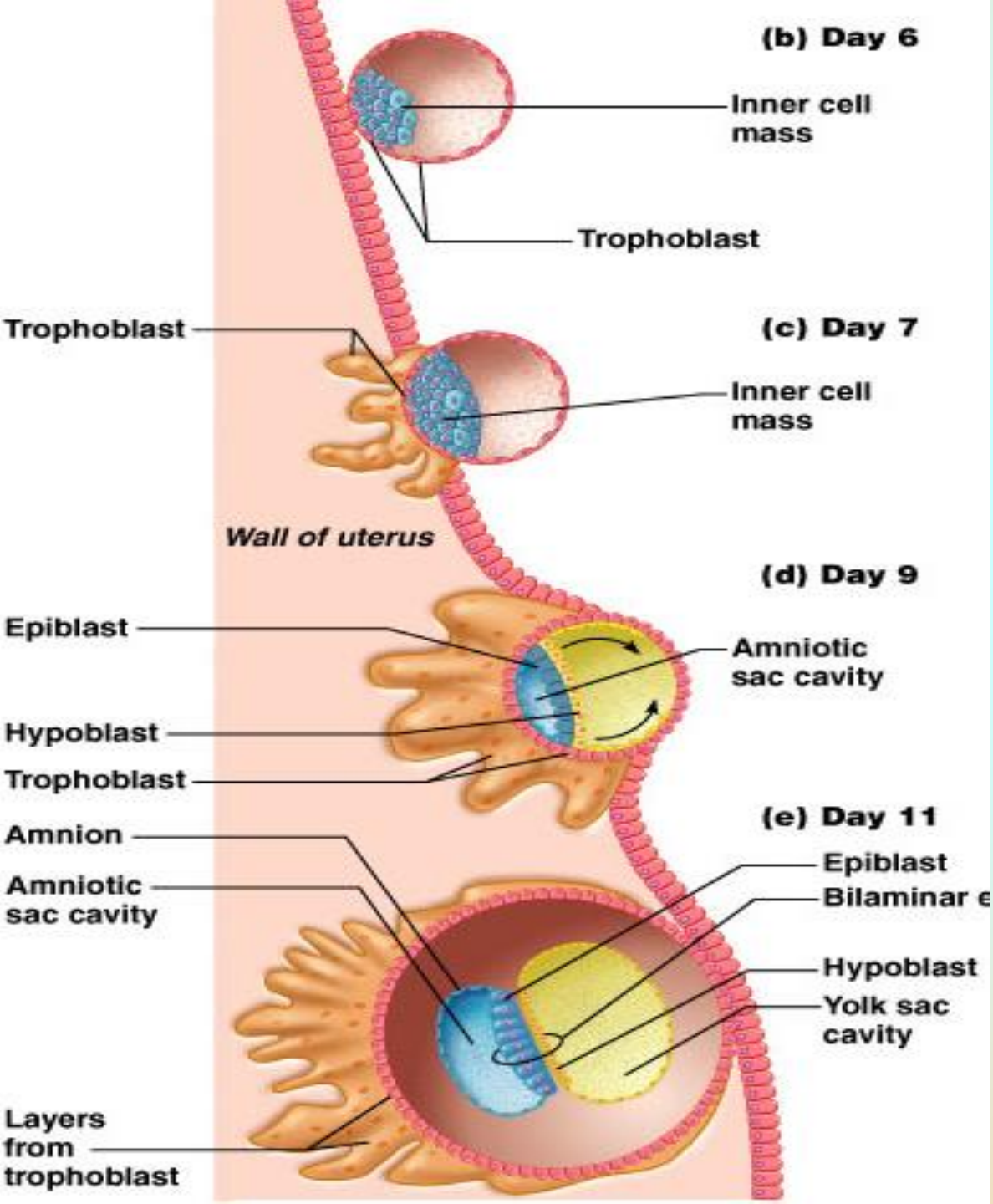
Complete Placenta Previa

ECTOPIC GESTATION



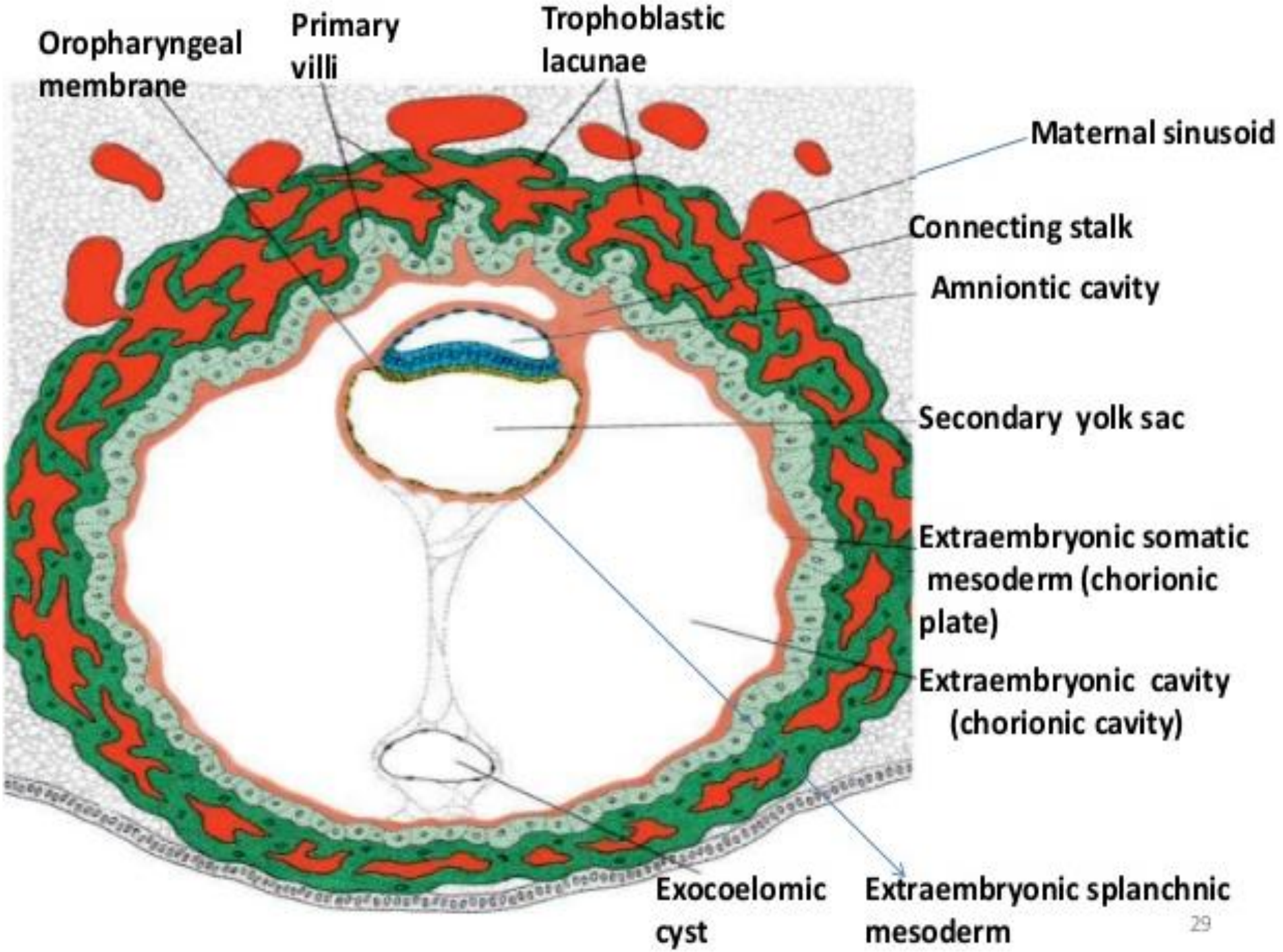
2ND WEEK OF DEVELOPMENT

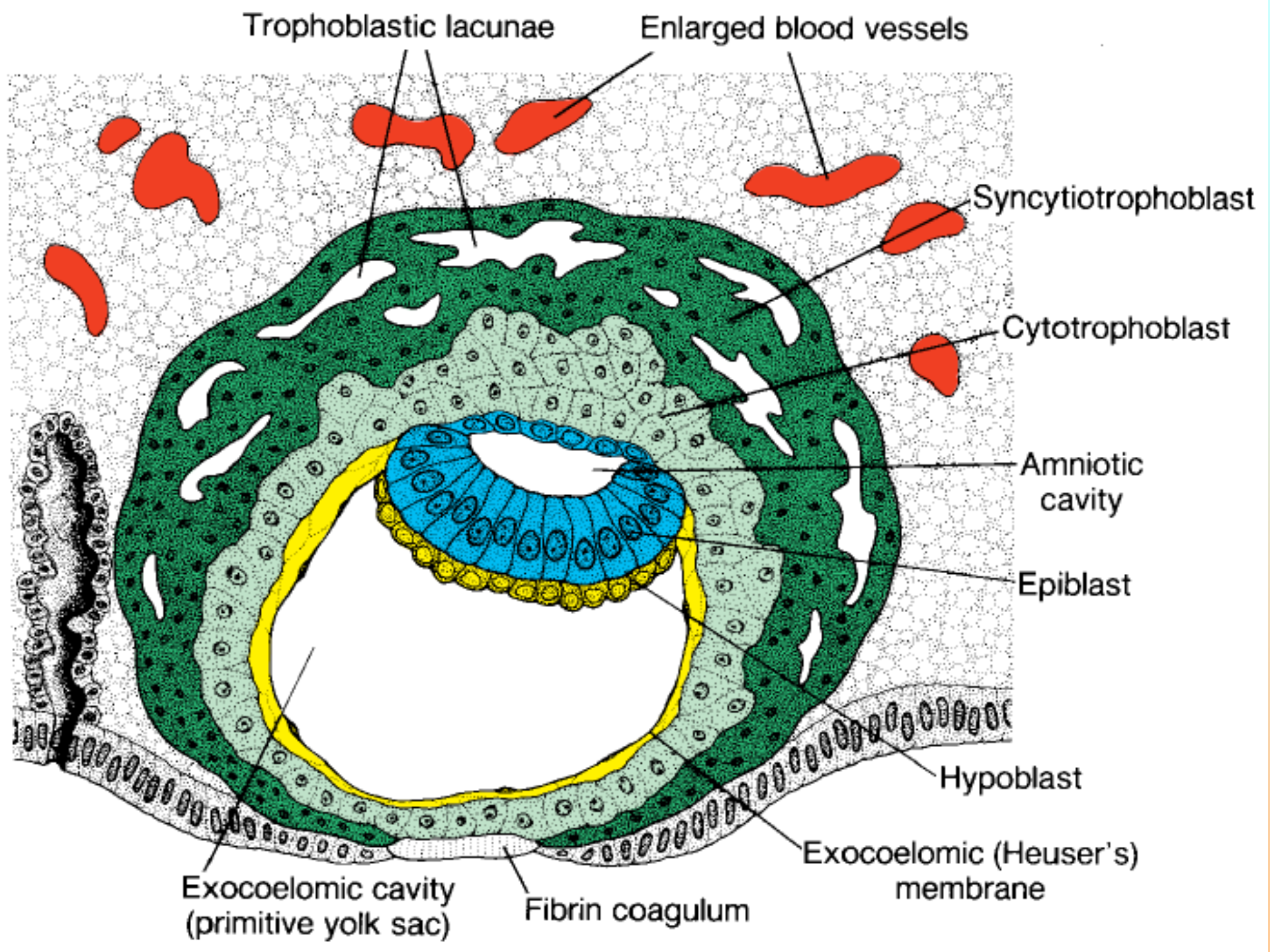
- Implantation (day 6 – 13)
- Differentiation of embryonic and placental structures
- The “week of twos”



"WEEK OF TWOs"

- 2 Cell masses
- 2 Poles
- 2 Embryonic layers
- 2 Cavities
- 2 Trophoblastic layers
- 2 Layers of extraembryonic mesoderm
- 2 mm thick
- 2 weeks


Oropharyngeal membrane
Primary villi
Trophoblastic lacunae
Maternal sinusoid
Connecting stalk
Amniontic cavity
Secondary yolk sac
Extraembryonic somatic mesoderm (chorionic plate)
Extraembryonic cavity (chorionic cavity)
Exocoelomic cyst
Extraembryonic splanchnic mesoderm


Trophoblastic lacunae
Enlarged blood vessels
Syncytiotrophoblast
Cytotrophoblast
Amniotic cavity
Epiblast
Hypoblast
Exocoelomic (Heuser's) membrane
Exocoelomic cavity (primitive yolk sac)
Fibrin coagulum

OTHER ABNORMALITIES

- ✓ Blighted ovum (anembryonic pregnancy)

OTHER ABNORMALITIES

- ✓ Hydatidiform mole – complete or partial mole

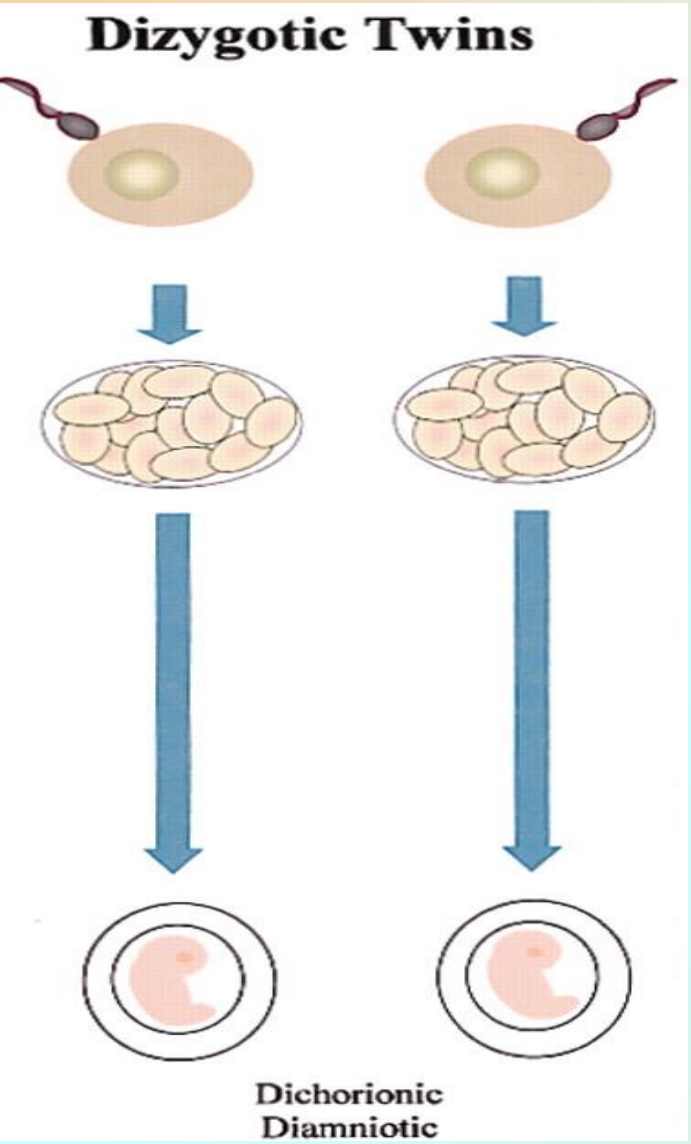
MULTIPLE GESTATION

- Incidence on the rise – fertility drugs for ovulation induction, and assisted reproductive technologies
- Twins, Triplets, Quadruplets, Quintuplets

TWIN GESTATION

- Dizygotic – from two zygotes
- Monozygotic – from one zygote

DYZYGOTIC TWINS



- Simultaneous shedding of two oocytes (double ovulation)
- Fertilization by different spermatozoa
- Different genetic constitutions - fraternal
- Majority
- Superfecundation?
- Heteropaternal superfecundation?

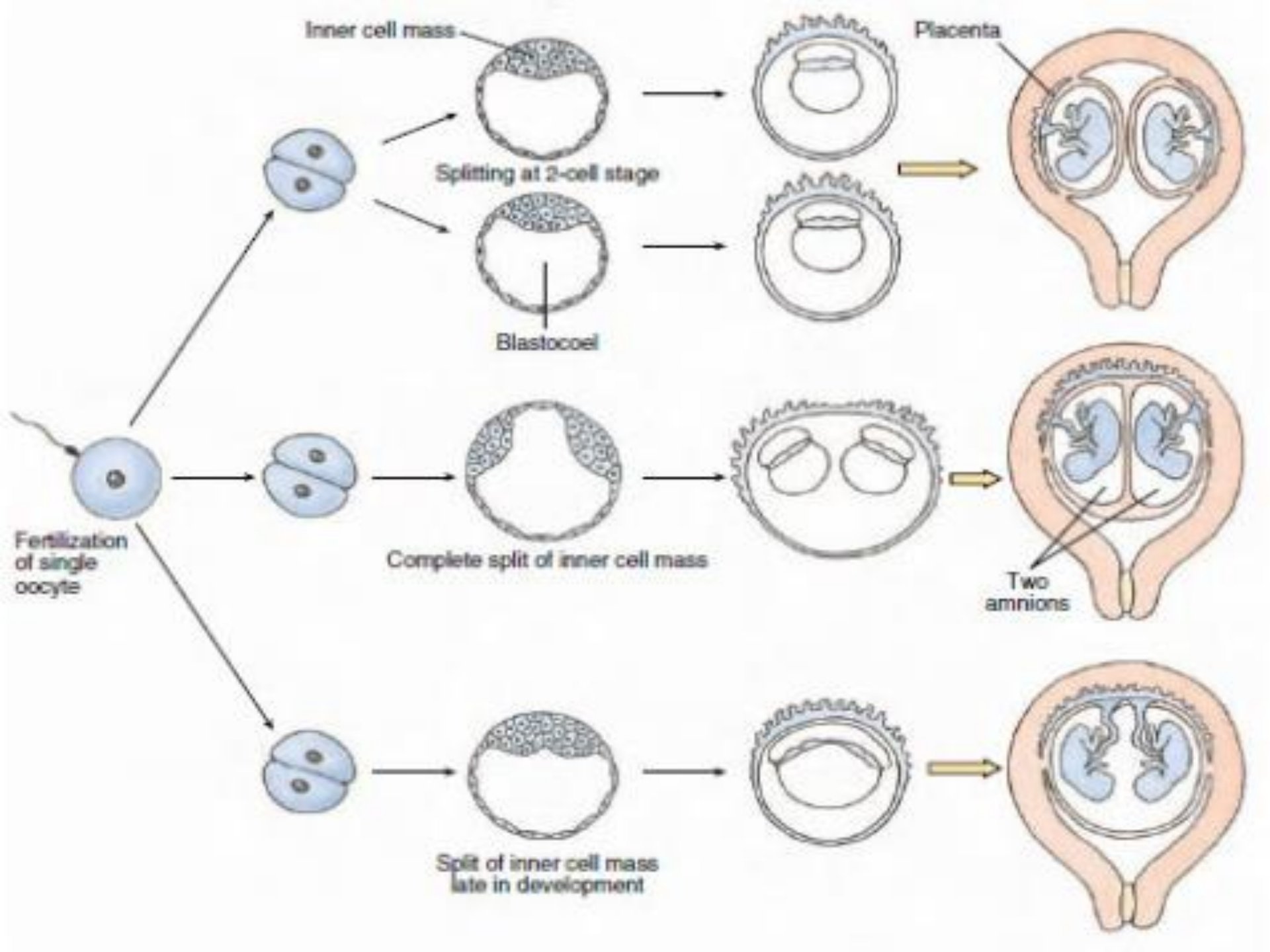
MONOZYGOTIC TWINS

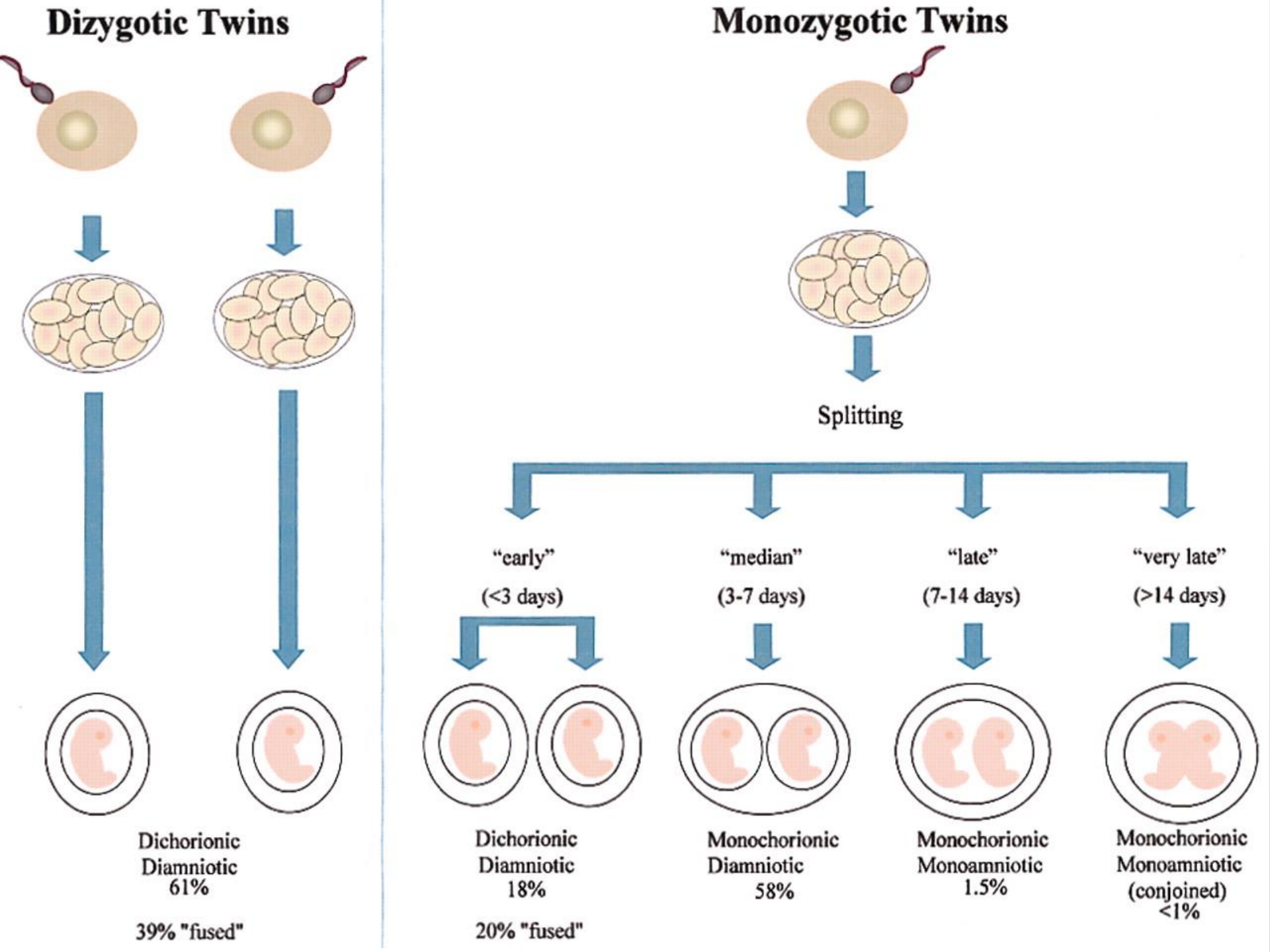
- Result from separation of the **embryonic cells** at various stages of **early** development

- Similar genetic constitution – identical twins

VARIETIES OF MONOZYGOTIC TWINS

- Dichorionic-diamniotic
- Monochorionic-diamniotic
- Monochorionic-monoamniotic
- Conjoined (Siamese)


Inner cell mass
Placenta
Splitting at 2-cell stage
Blastocoel
Fertilization of single oocyte
Complete split of inner cell mass
Two amnions
Split of inner cell mass late in development


Dizygotic Twins
Monozygotic Twins
Splitting
"early"
(<3 days)
"median"
(3-7 days)
"late"
(7-14 days)
"very late"
(>14 days)
Dichorionic
Diamniotic
61%
39% "fused"
Dichorionic
Diamniotic
18%
20% "fused"
Monochorionic
Diamniotic
58%
Monochorionic
Monoamniotic
1.5%
Monochorionic
Monoamniotic
(conjoined)
<1%

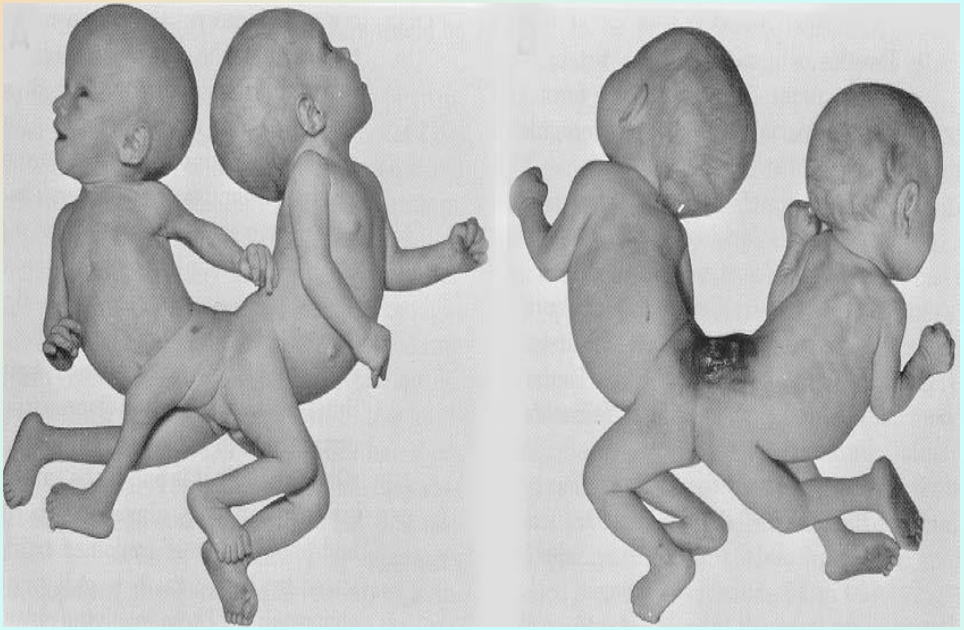
CONJOINED TWINS

- Separation at later stages of early development
- Partial splitting of the primitive streak
- Classified according to body organs/regions shared

ABDOMINOPAGUS/OMPHALOPAGUS

THORACOPAGUS

PYGOPAGUS



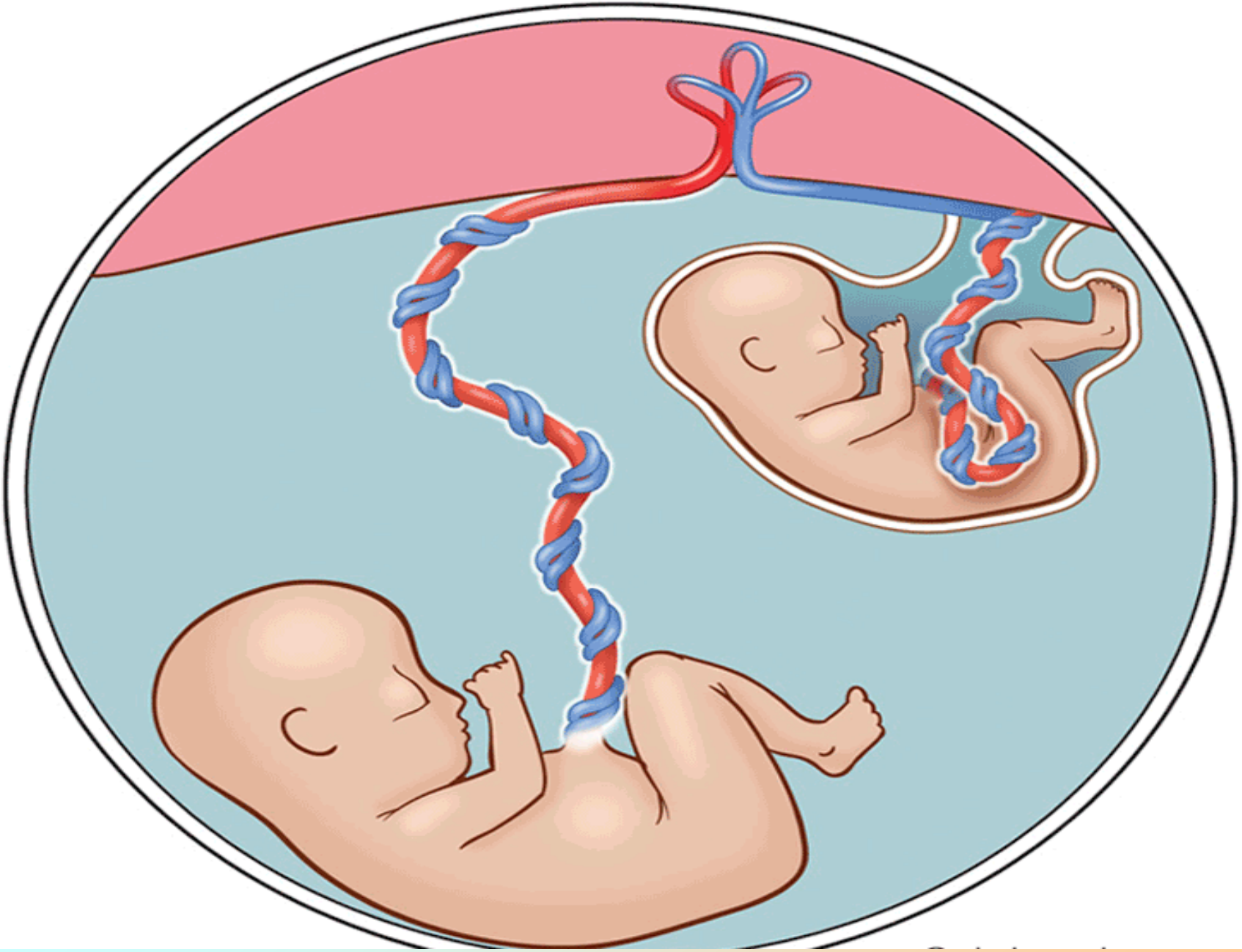
CRANIOPAGUS

COMPLICATIONS OF MULTIPLE GESTATION

- Conjoined
- Prematurity
- Low birth weight

PARASITIC TWINS

Twin Twin Transfusion Syndrome



VANISHING TWIN

FETUS PAPYRACEUS

THE END