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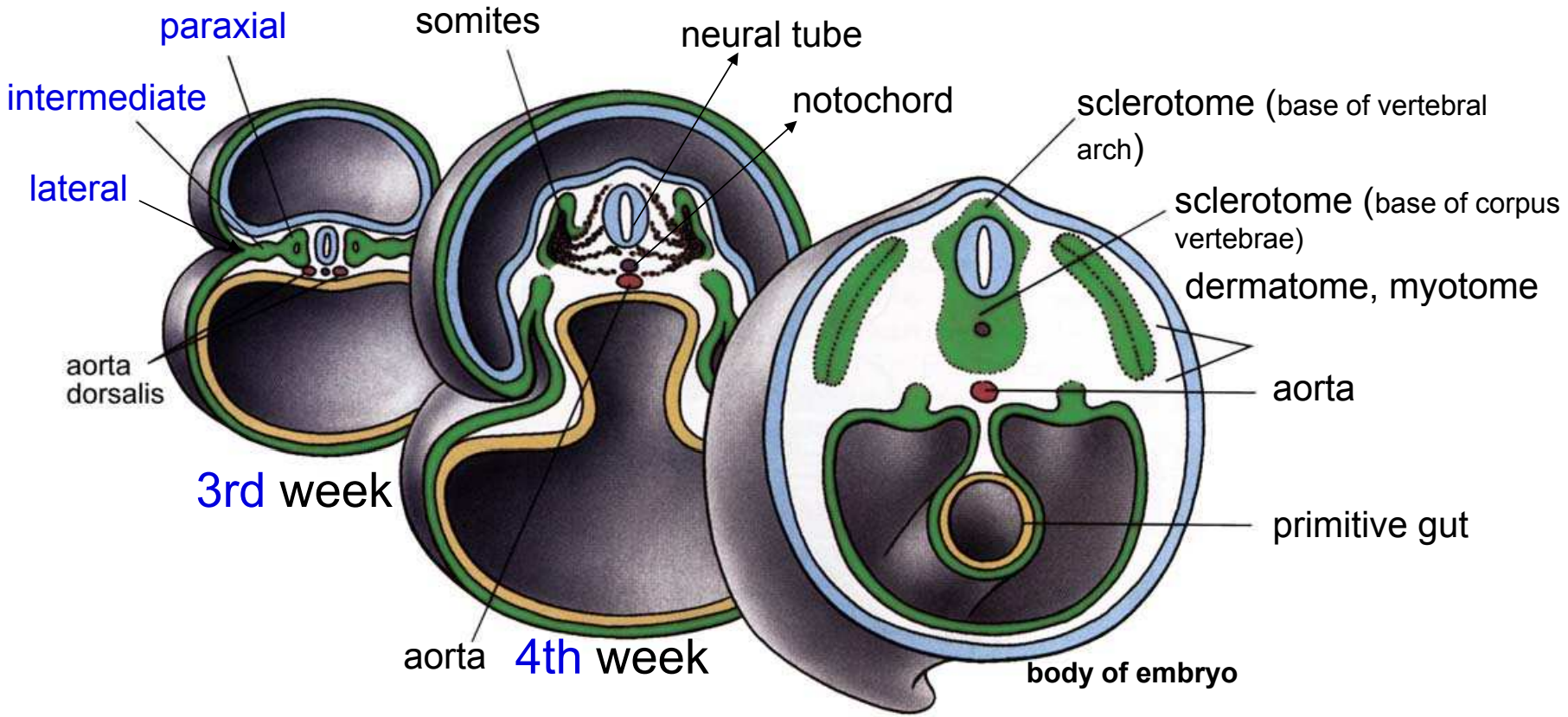
GENERAL EMBRYOLOGY 2

- Folding of the embryo – 4th week of development
- Development of extraembryonic structures – extraembryonic mesoderm, extraembryonic coelom, yolk sac, fetal membranes: amnion and chorion.
- Development of the placenta. Anomalies of the placenta and umbilical cord.

- Multiple pregnancy – arrangement of fetal membranes.
- The length of pregnancy, calculation of delivery date.
- Fetus position in the uterus – *situs, positio*, *praesentatio,* and *habitus*. The length and weight of fetus during i.u. development. The rule of Haase.
- Mature and full-term fetus, marks of mature fetus.

4th week – folding of the embryo (flexion)



Differentiation of intraembryonic mesoderm

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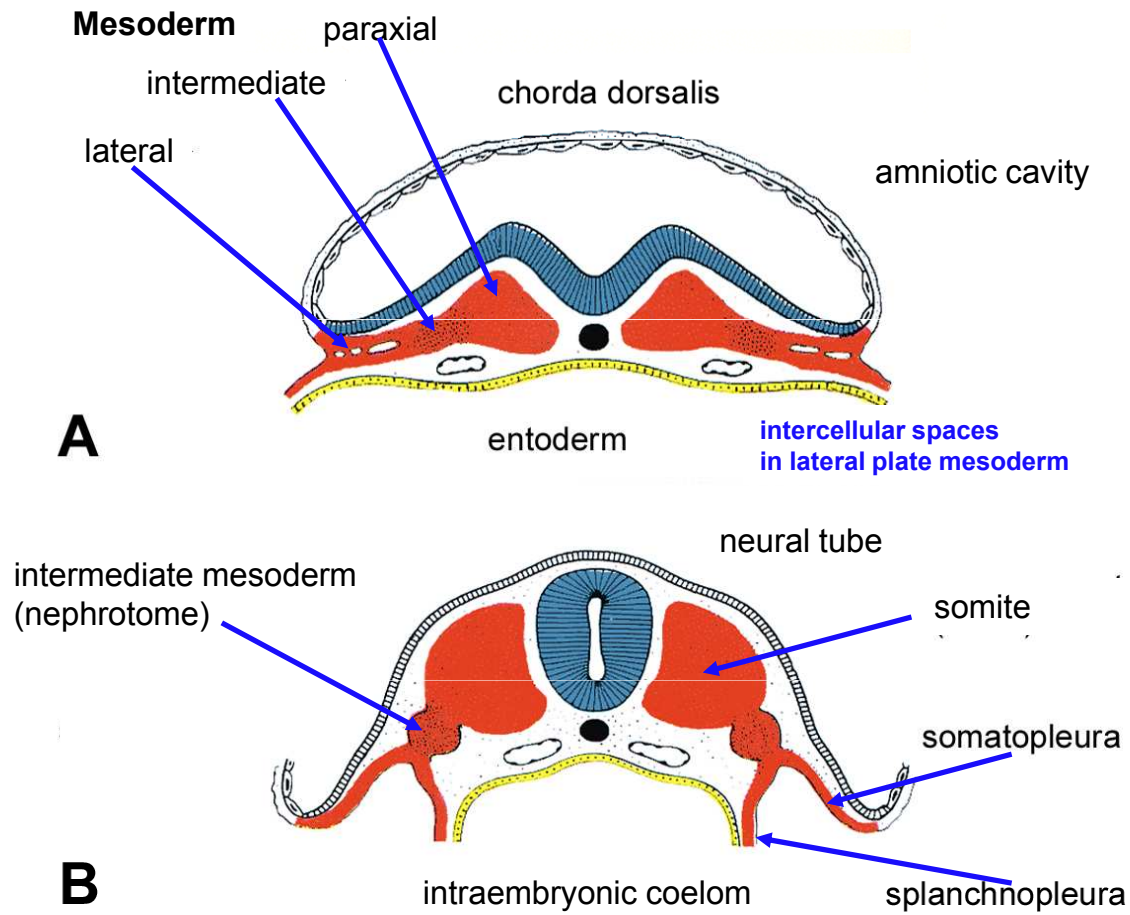

Mesoderm:

- **paraxial mesoderm** – thickened region of mesoderm along neural tube
- **intermediate mesoderm (nephrotome)** – in between paraxial and lateral mesoderm
- **lateral mesoderm** – keeps sheet-like structure

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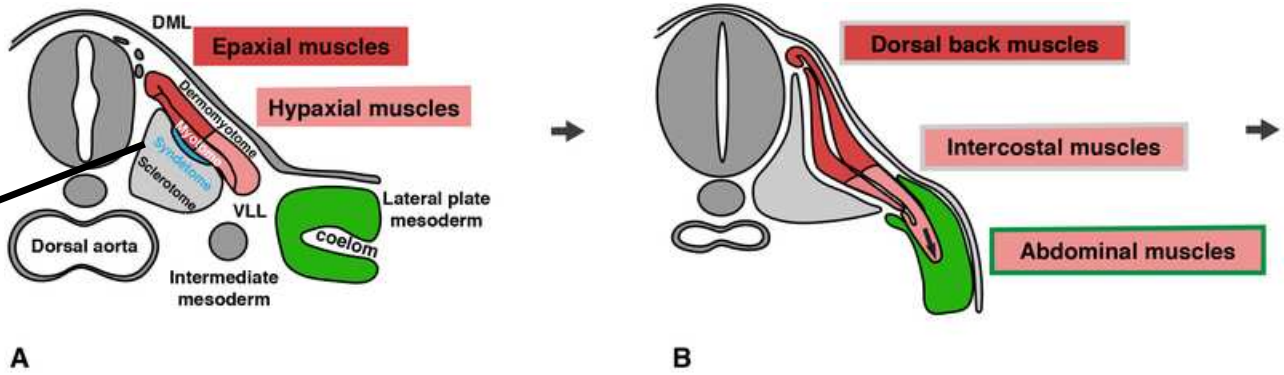
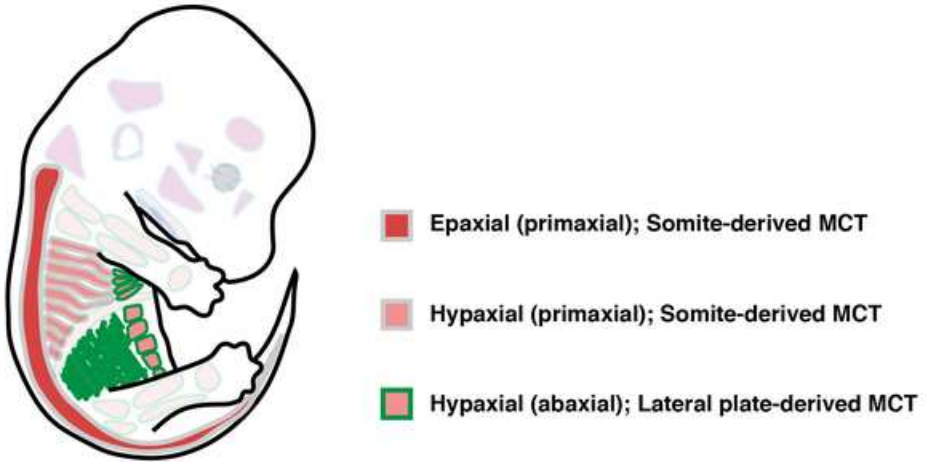
Differentiation of intraembryonic mesoderm – paraaxial (somites)



Somite
→ Dermatome, Myotome, Sclerotome



4 Sefton EM, 2019
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6449175/

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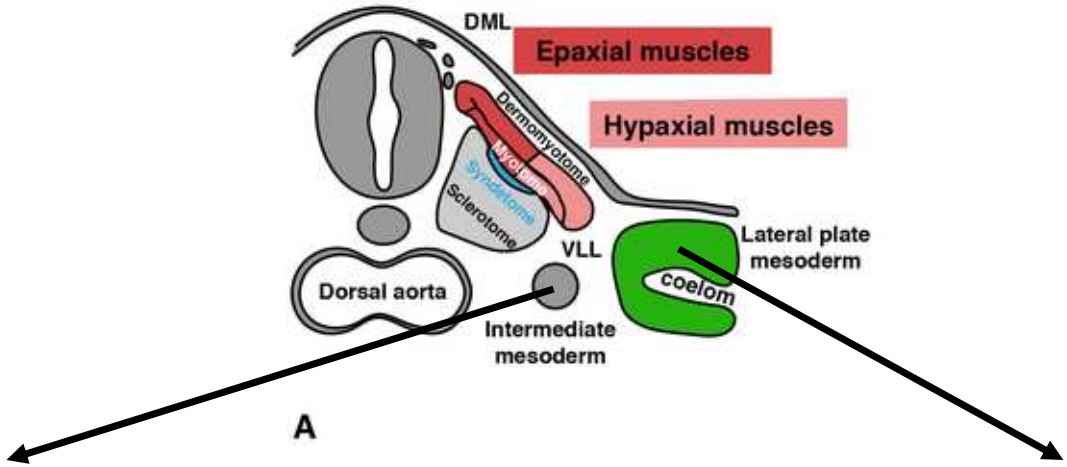
Differentiation of intraembryonic mesoderm – intermediate and lateral



Intermediate mesoderm

→ urinary system (kidney, ureter), genital system (gonads, ducts, accessory glands)

Lateral mesoderm (parietal and visceral layer)

→ dermis, hypodermis of ventral body parts, connective tissue and muscle of viscera, serous membranes, blood and lymphatic vessels, spleen

Sefton EM, 2019
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6449175/

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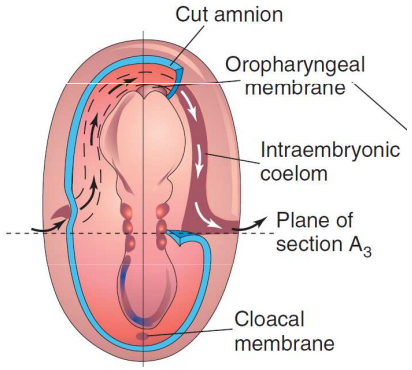
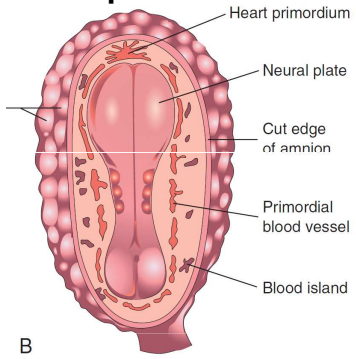
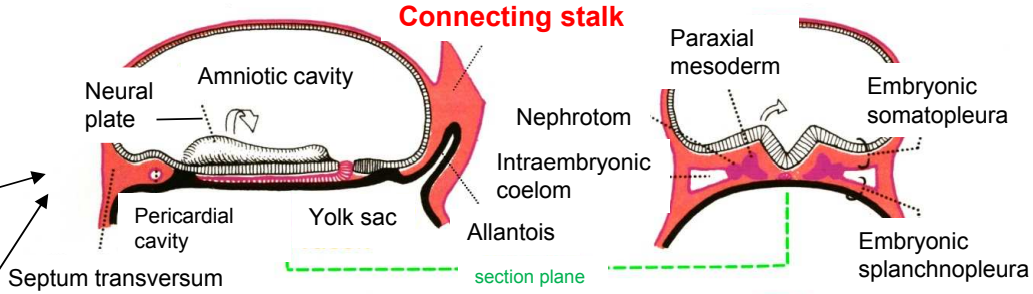
EMBRYO FOLDING

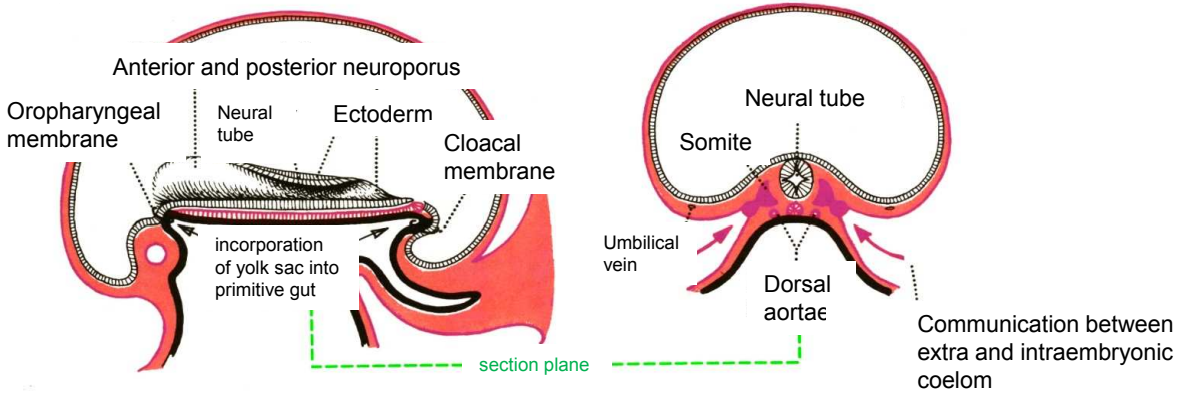
Intraembryonic coelom – horseshoe shape

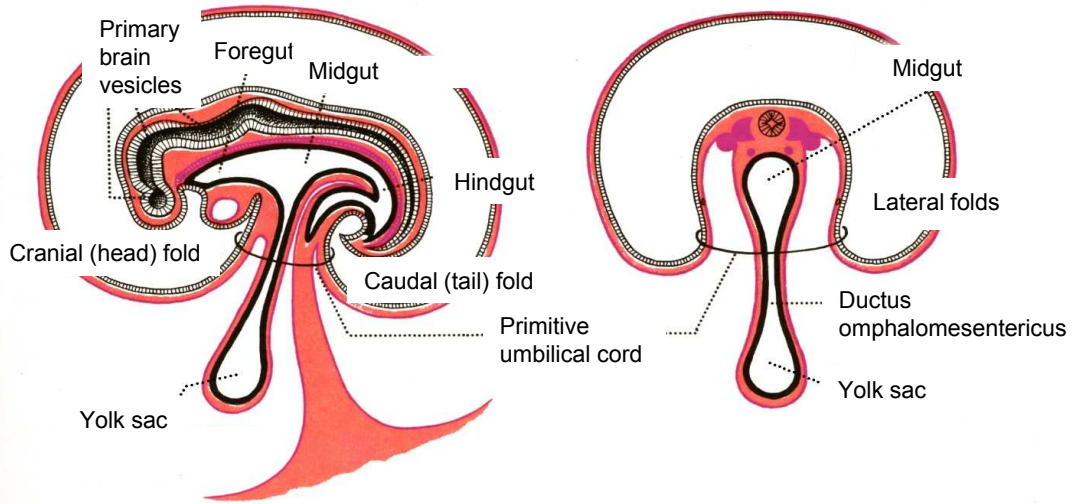


Heart primordium









Moore et al., Before we are born, 2013, 8th ed.

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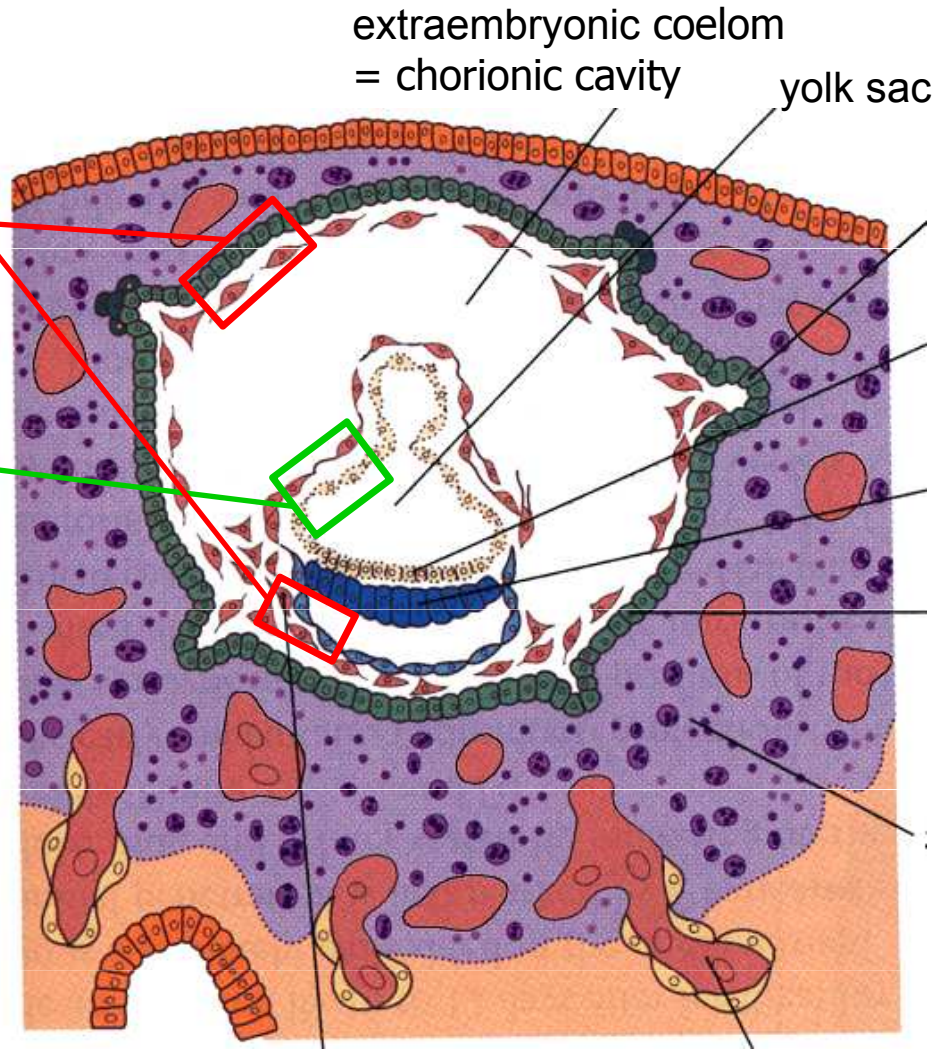
Extraembryonic mesoderm

parietal layer =
extraembryonic somatopleura
+ trophoblast → chorion
+ amniotic ectoderm → amnion

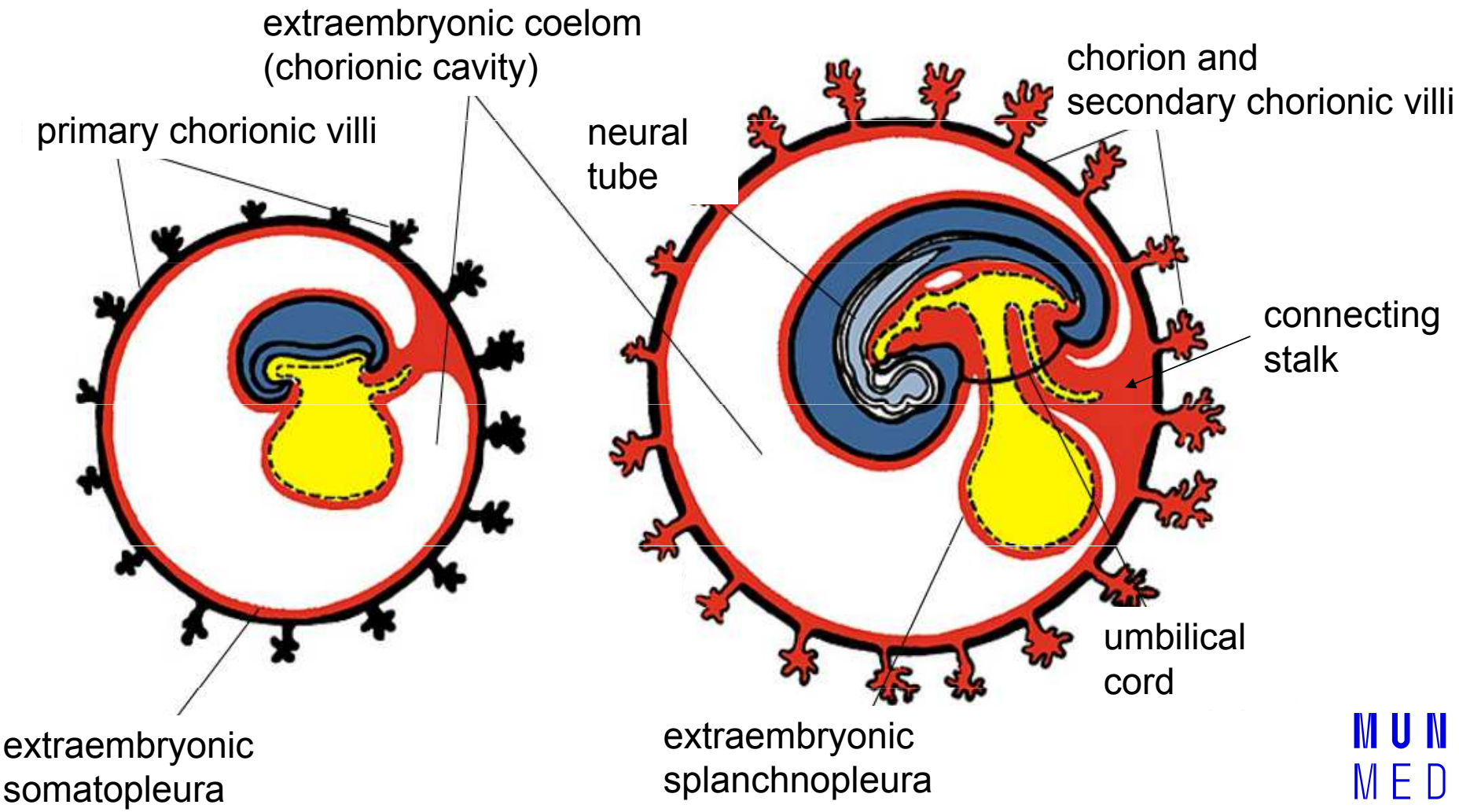
visceral layer =
extraembryonic splanchnopleura
+ extraembryonic endoderm → yolk sac



chorionic villi

- **primary** – cytotrophoblastic buds (day 10) covered with syncytiotrophoblast
- **secondary** - with extraembryonic mesoderm (days 12-13)
- **tertiary** – vascularized extraembryonic mesoderm (days 17-18)

Yolk sac, amniotic sac, fetal membranes - amnion, chorion



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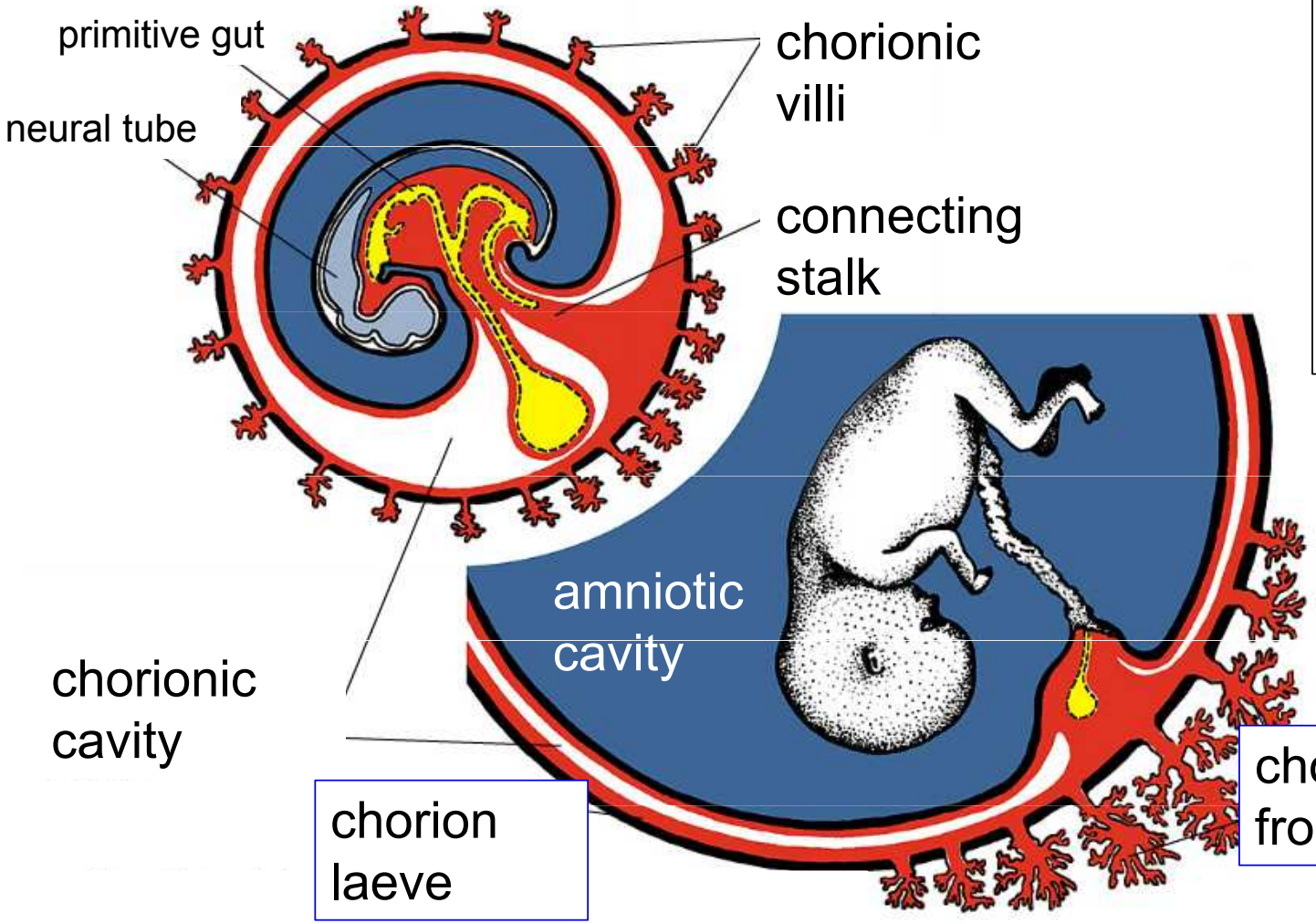
Development of fetal membranes



Different growth of chorionic villi toward **decidua basalis** (partially decidua marginalis) and toward decidua capsularis causes division of chorion into parts:
CHORION FRONDOSUM (toward decidua basalis – with villi) and **CHORION LAEVE** (smooth, without villi)

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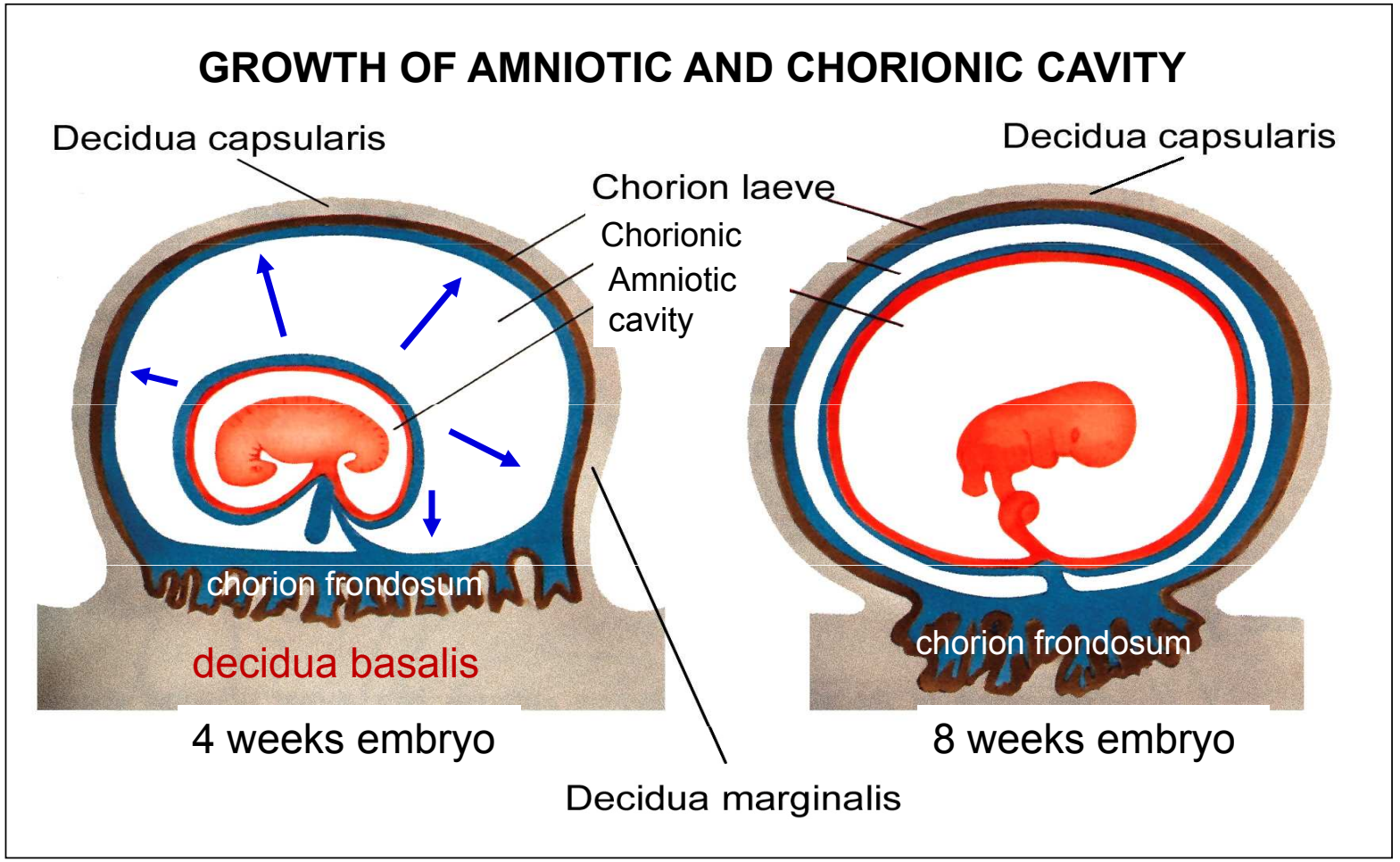
CHORION = extraembryonic mesoderm + cytotrophoblast + syncytiotrophoblast
AMNION = extraembryonic mesoderm + amniotic ectoderm

decidua
- basalis
- capsularis
- marginalis
- parietalis



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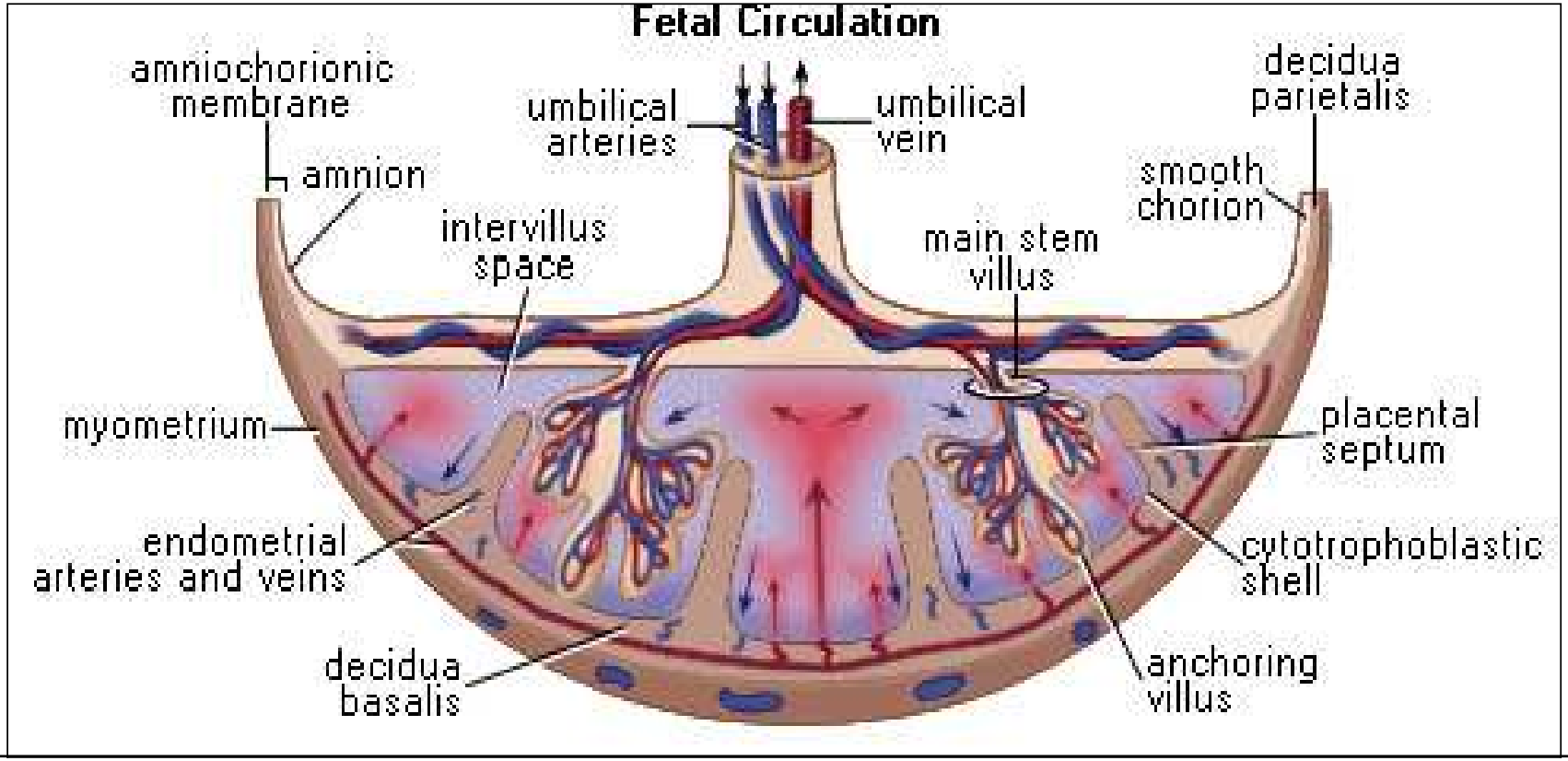
COMPARTMENTS OF PLACENTA:

⇨ **PARS FETALIS PLACENTAE** – chorionic plate + chorionic villi, intervillous space

⇨ **PARS MATERNA PLACENTAE** = zona functionalis deciduae basalis



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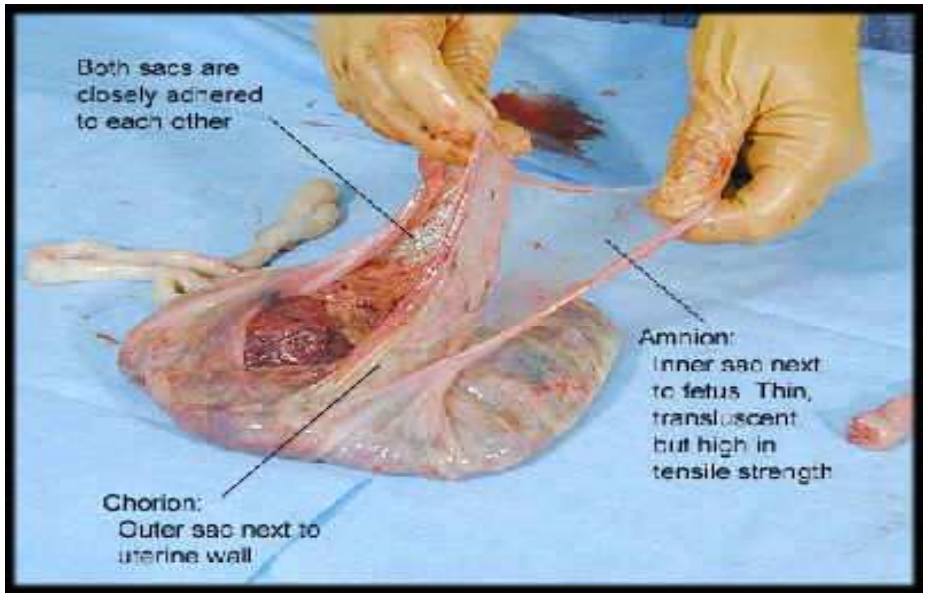
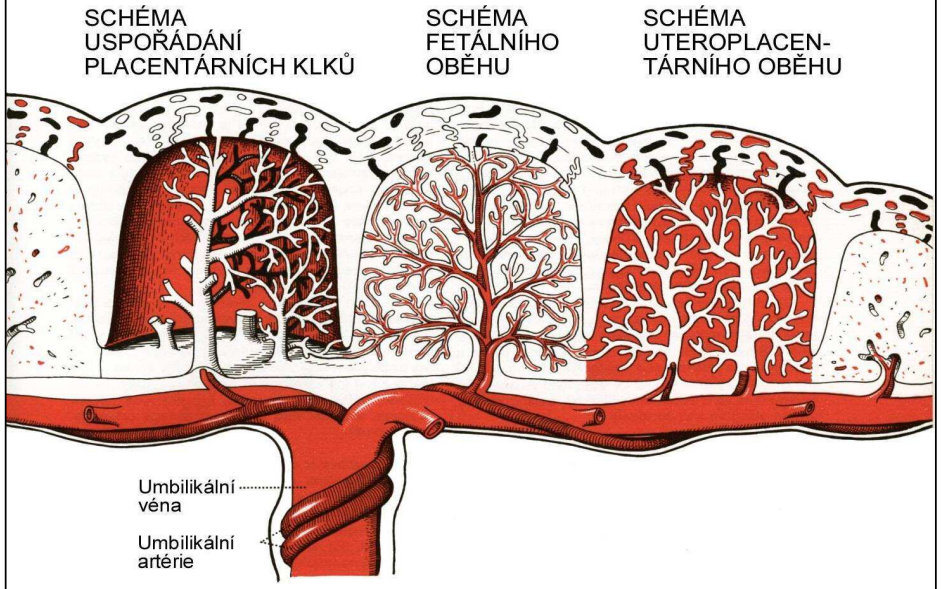
Human placenta

- **discoidalis**
- olliformis
- **hemochorialis**

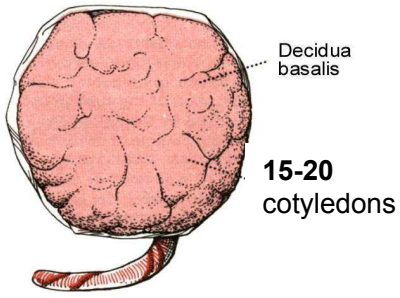


∅ 15-25 cm
width 2-3 cm
weight 500 g

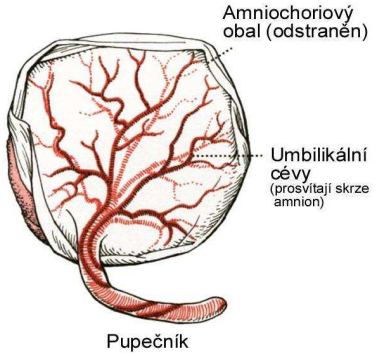
Full-term placenta



maternal surface



fetal surface



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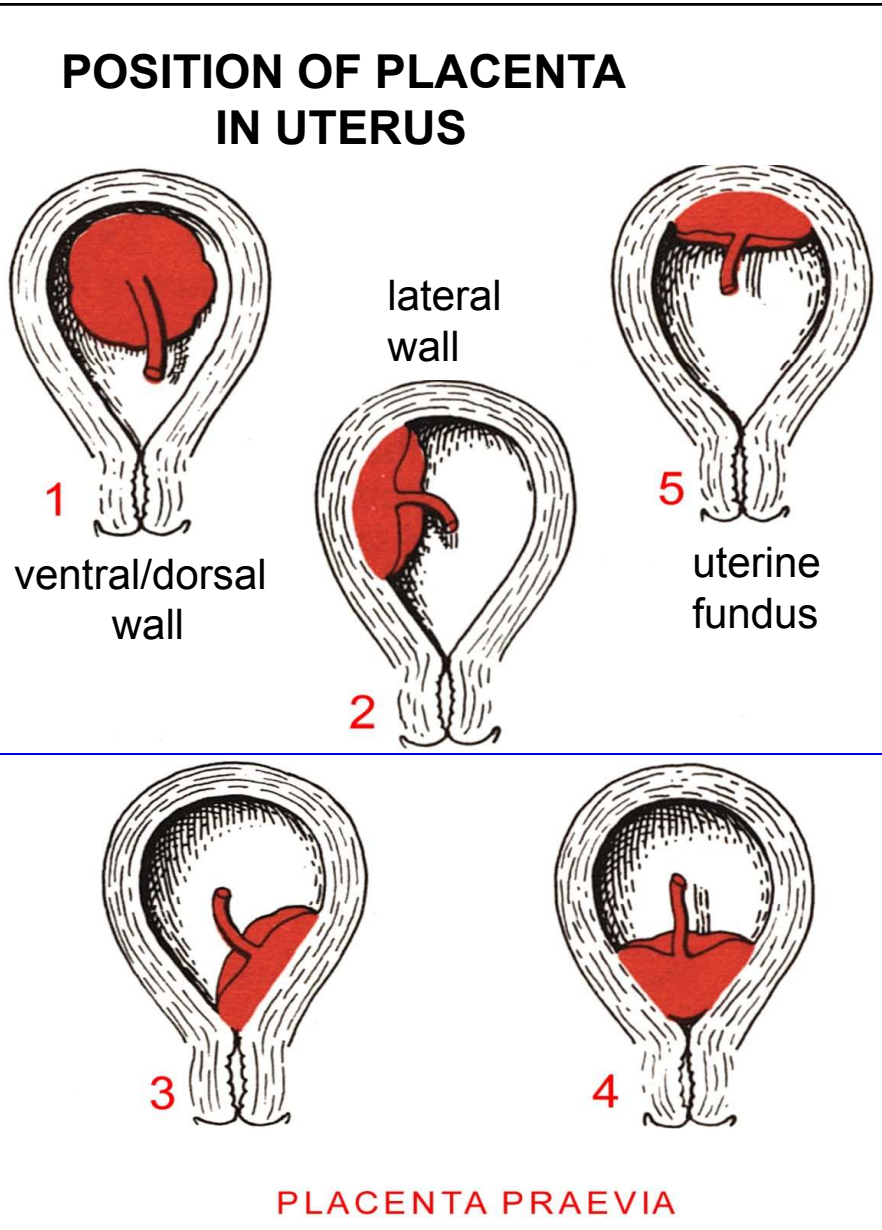
normal

anomaly



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Anomalies of placenta

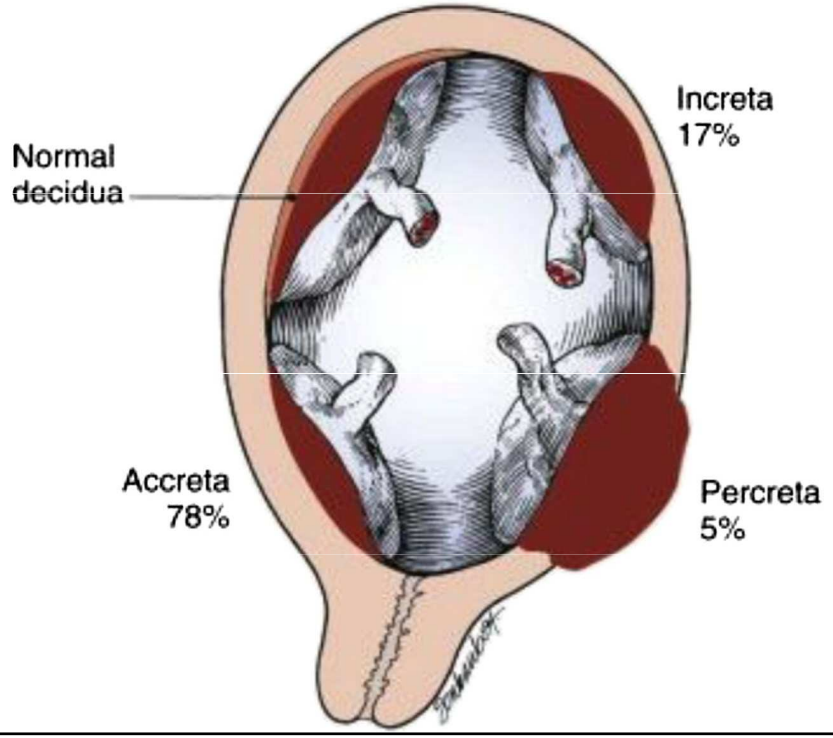
Anomalies of chorionic villi (1 : 100 pregnancies)

- **mola hydatidosa**
- **chorionepitheliom**

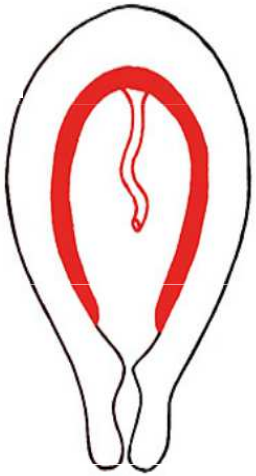
Anomalies in location:

- **placenta praevia** (causes bleeding in week 28)
  - absolute indication to CS

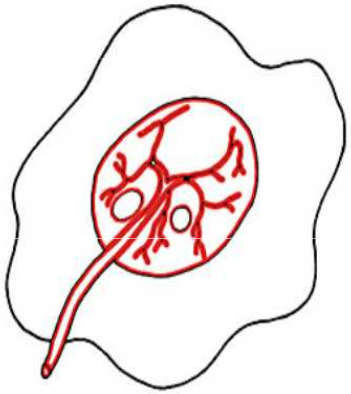
- **placenta accreta** (attached to myometrium)
- **placenta increta** (grown into myometrium)
- **placenta percreta** (grown through myometrium)



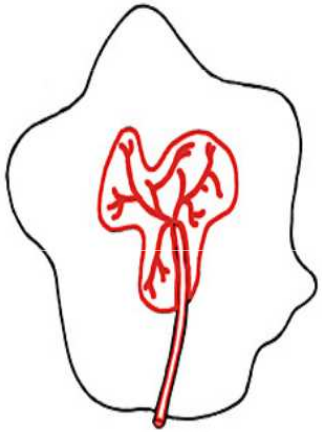
Anomalies of shape of placenta



placenta membranacea

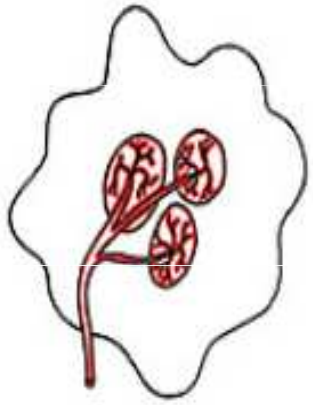


placenta fenestrata

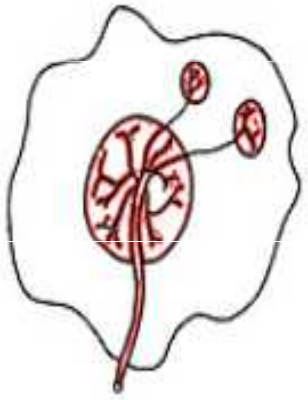


placenta tripartita

placenta duplex



placenta triplex



placenta succenturiata

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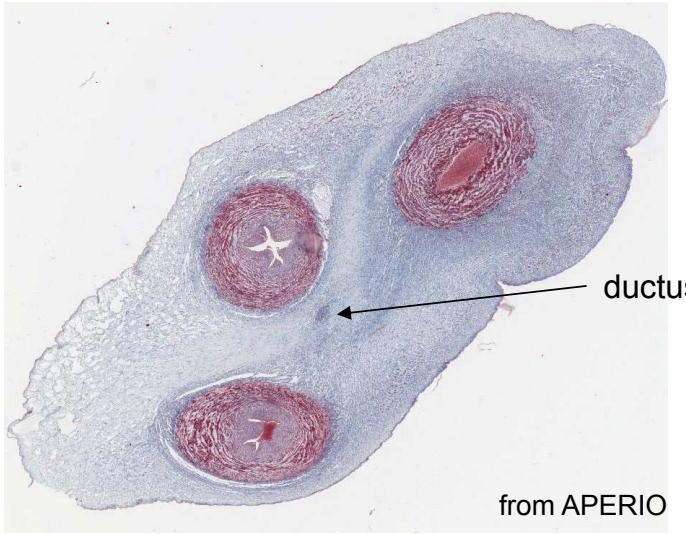
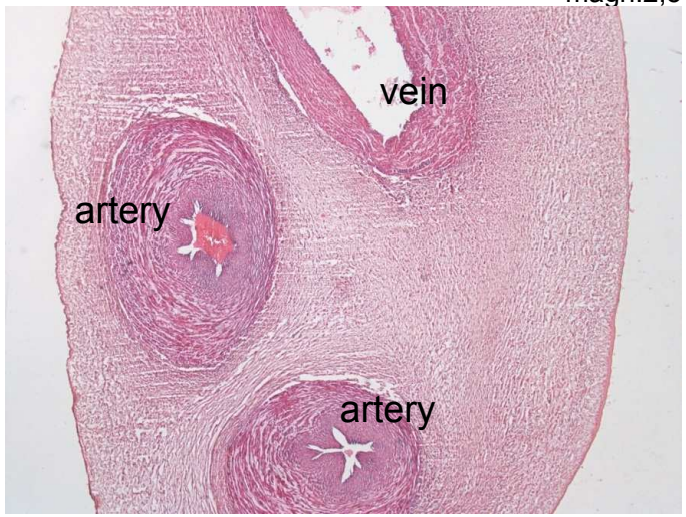
Funiculus umbilicalis (HE, HES, AZAN)

- 50 – 60 cm long
- 1,5 – 2 cm wide
- amniotic ectoderm on the surface
- jelly-like connective tissue with umbilical vessels

magn:2,5





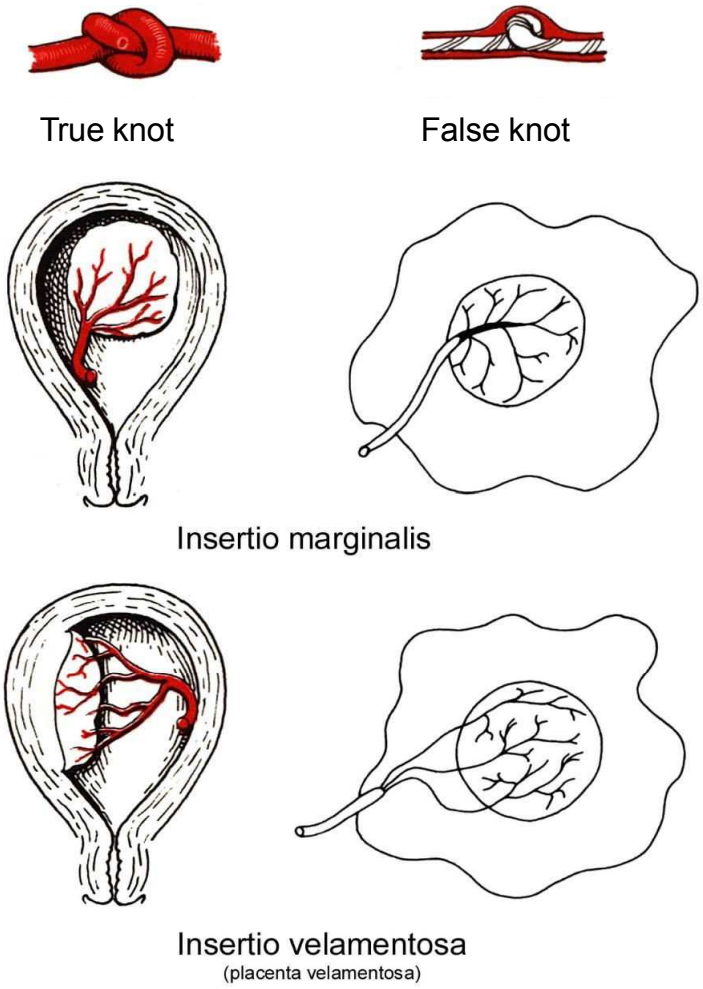
magn:2.5

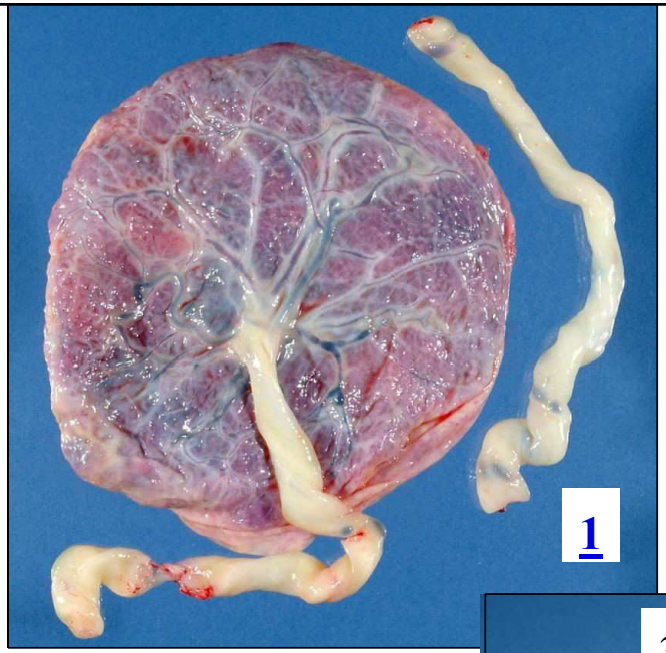
Anomalies of umbilical cord

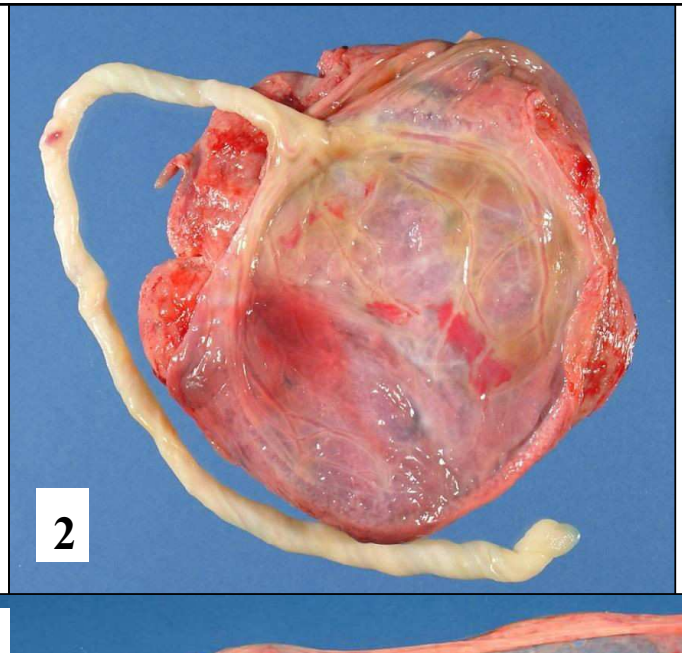
- short (< 40 cm)
- long (> 60 cm)
(danger of strangulation or formation of true knots)

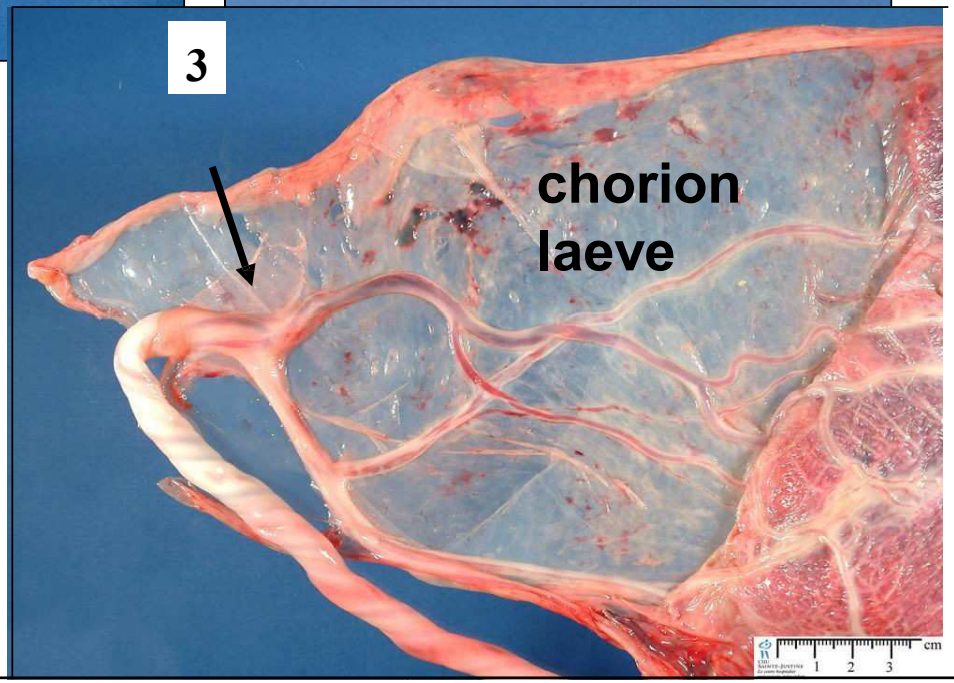
- true and false knots

- absence of 1 umbilical artery *(hypotrophic fetus)*







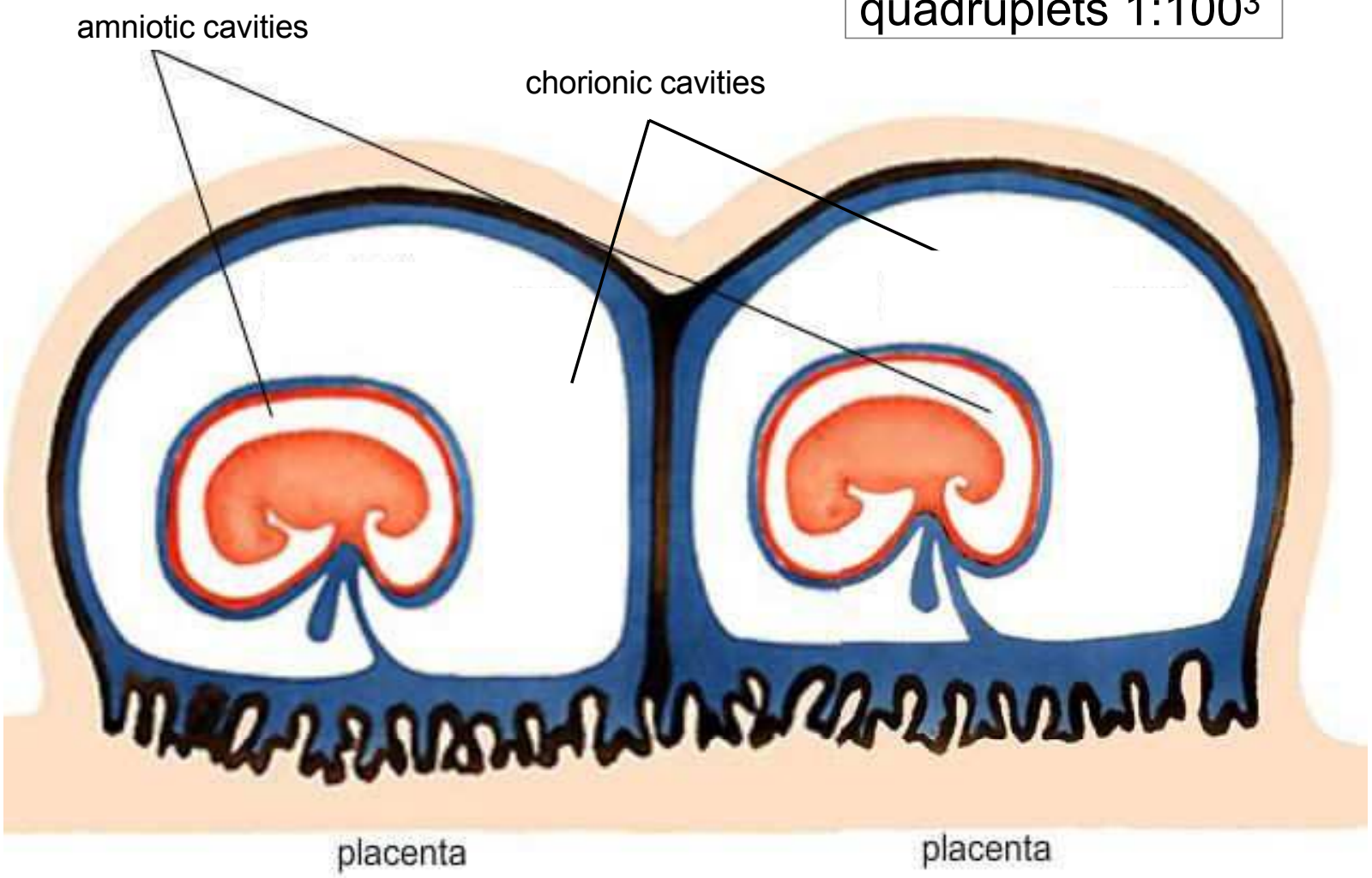


Umbilical cord – placenta insertion

1 – insertio centralis
2 – insertio marginalis
3 – insertio velamentosa

Multiple pregnancy

twins 1:100
triplets 1:100^2
quadruplets 1:100^3



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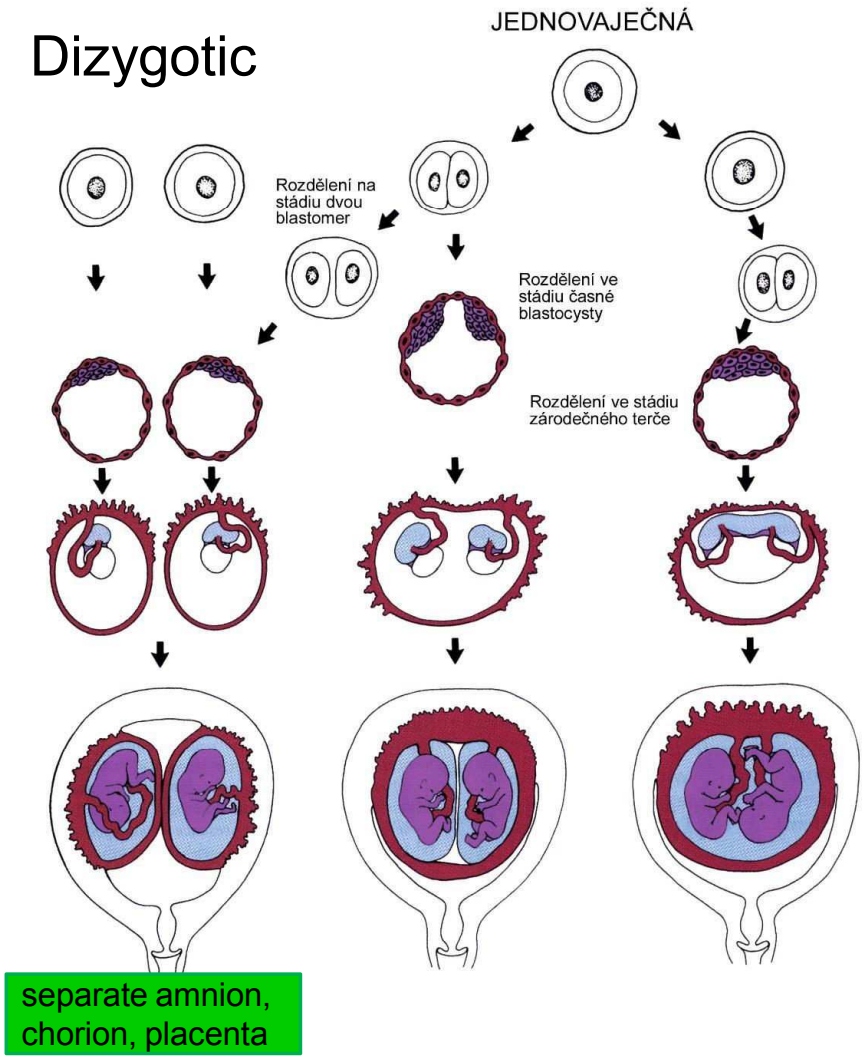
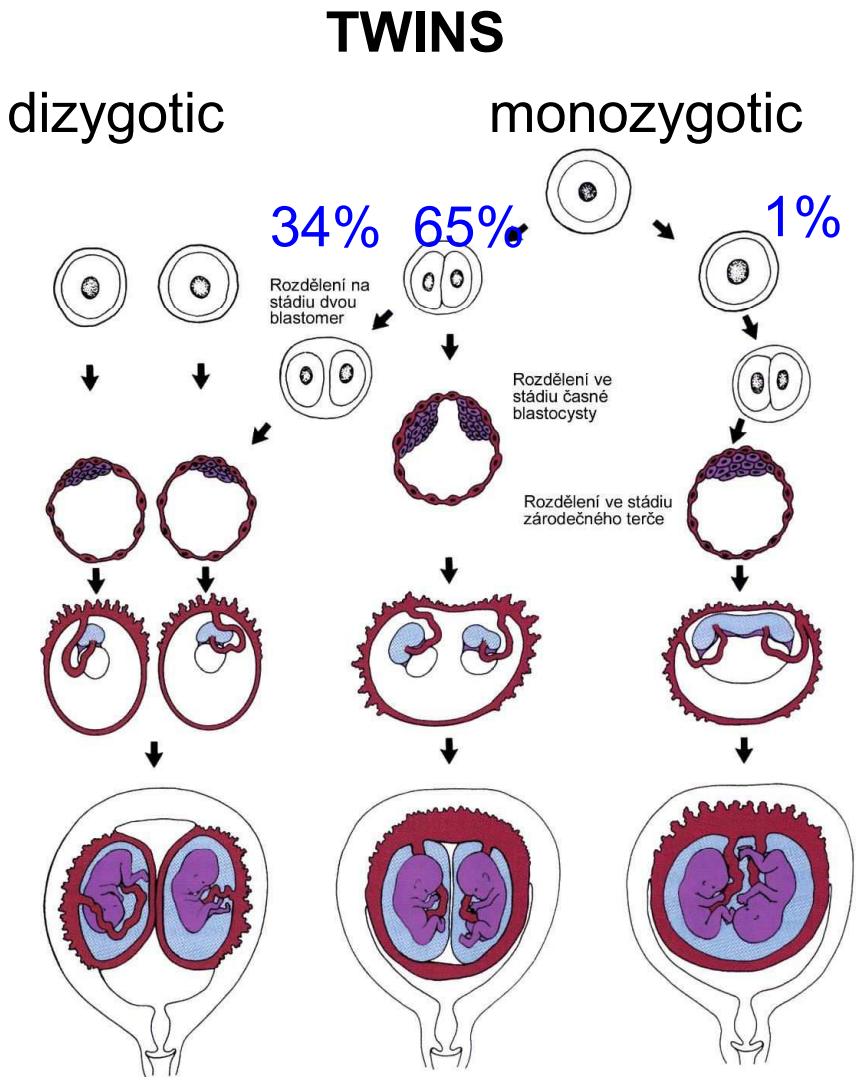
DIZYGOTIC TWINS

- **2 spermatozoa fertilize 2 oocytes**
- each embryo develops separately (has its own amnion, chorion, and placenta)
- twins can be of different sexes
- resemblance of twins as between siblings of different age



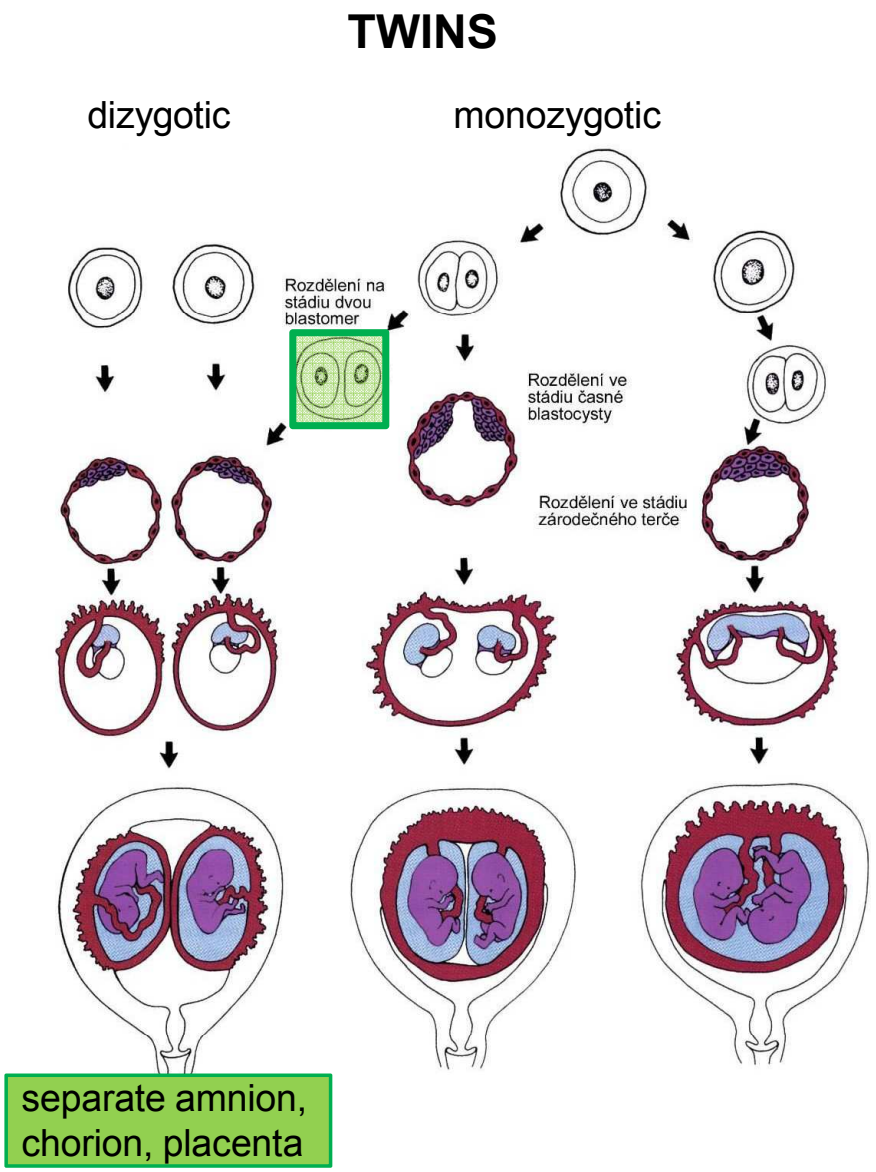
MONOZYGOTIC TWINS

- **1 spermatozoon fertilizes 1 oocyte**
- splitting of embryo occurs during the further development
- arrangement of fetal membranes **depends on stage** on which splitting occurs
- **twins are always genetically identical and of the same sexes**



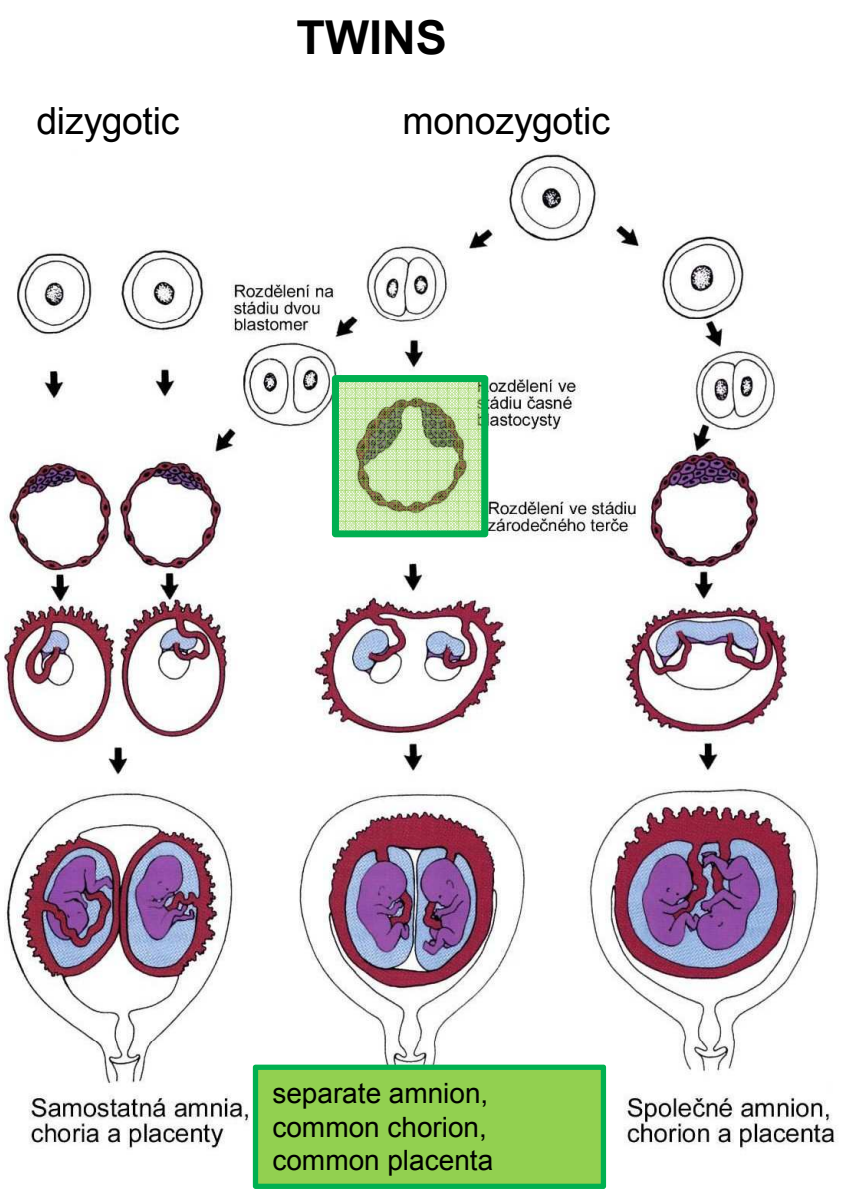
MONOZYGOTIC separated on stage of 2 blastomeres

- **each of 2 blastomeres creates 1 embryo**
- 2 blastocysts are formed
- they implantate separately
- **fetal membranes are as in dizygotic twins:** separate amnion and chorion **(diamniotic,dichorial),** and own placenta



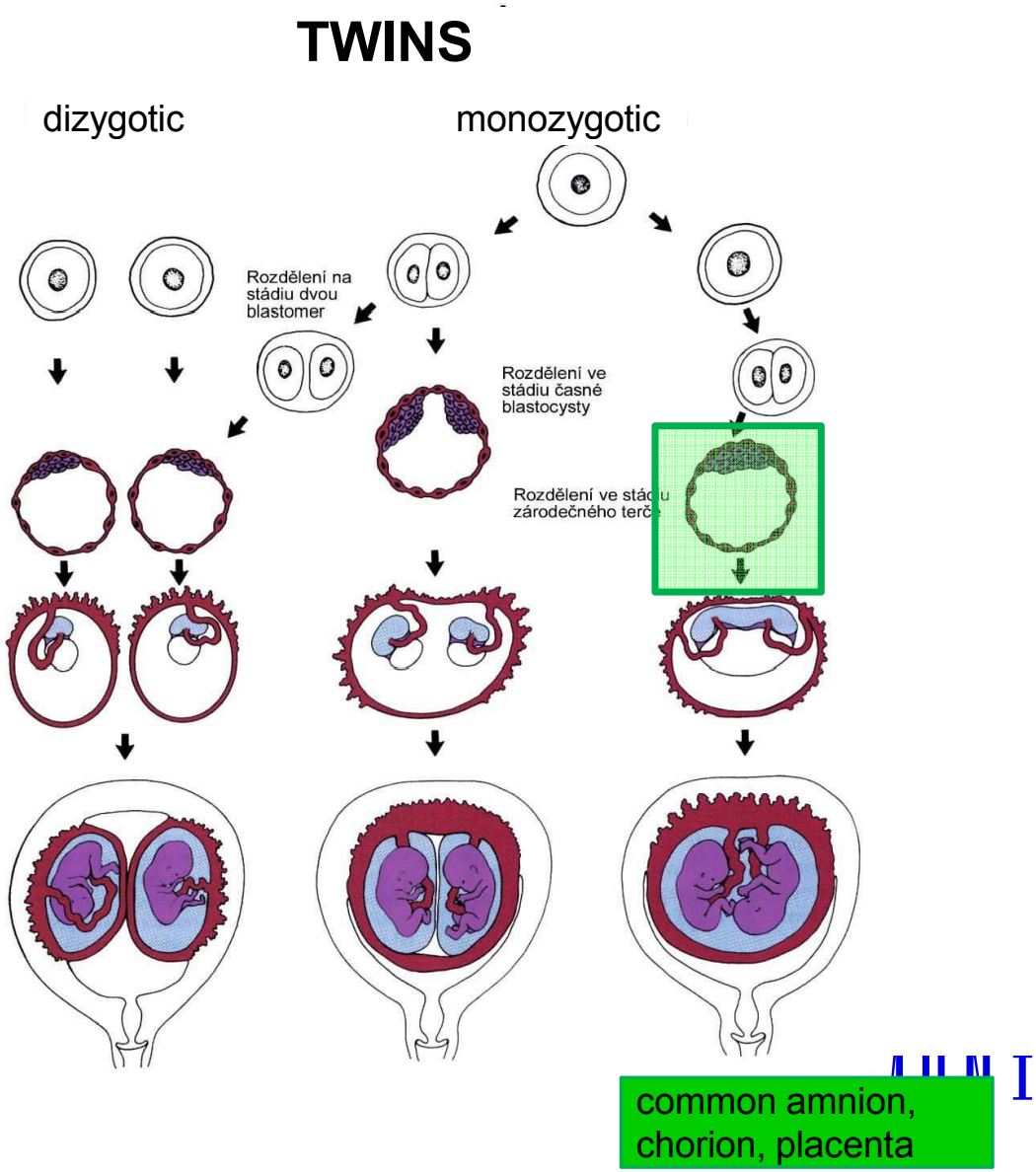
MONOZYGOTIC separated on stage of blastocyst

- **embryoblast divides into 2 cell clusters** before creation of germ disc
- trophoblast does not separate, remains common
- **fetal membranes:** separate amnion **(diamniotic),** common chorion **(monochorial)** and common placenta
- the most frequent (65 %)

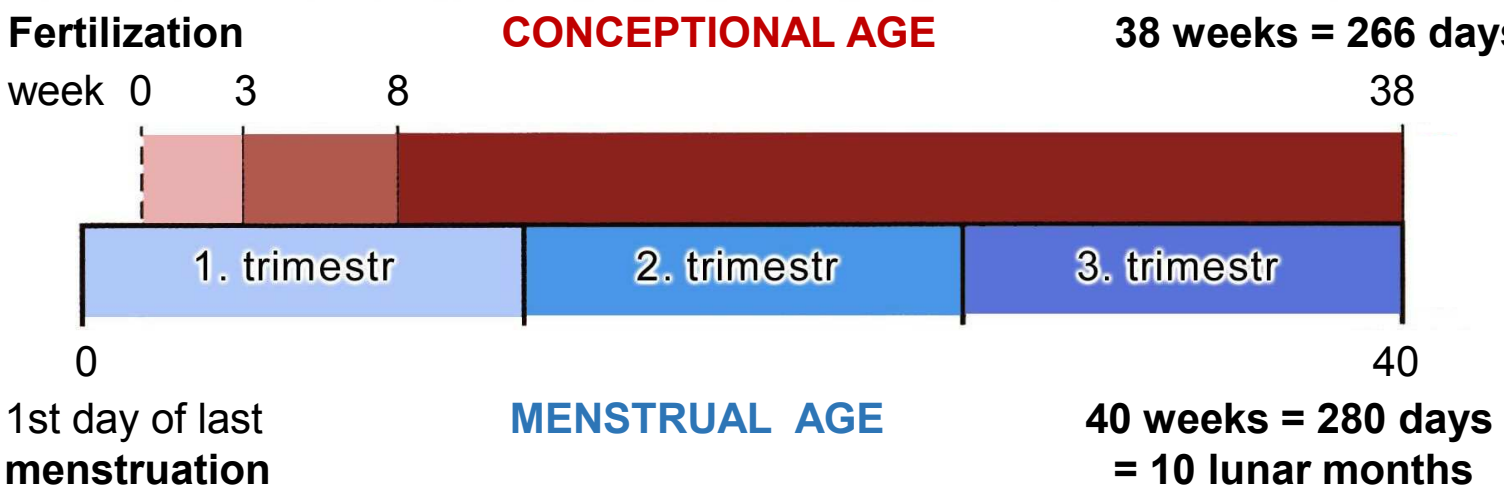


MONOZYGOTIC separated on stage of bilaminar germ disc

- **creation of 2 primitive streaks**
- **fetal membranes are common** – amnion, chorion, placenta **(monochorial, monoamniotic)**
- conjoined „Siamese“ twins develop in case of incomplete separation



Length of pregnancy



Calculation of the expected date of delivery:

Date of the 1st day of the last menstruation + 9 calendar months + 7 days

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Rule of Haase

determine the age of fetus according its length

AGE (lunar month)		CRL* (cm)
3.	3^2 (the second power of l.m.)	= 9 cm
4.	4^2	= 16 cm
5.	5^2	= 25 cm
6.	6x5 (l.m. x 5)	= 30 cm
7.		= 35 cm
8.		= 40 cm
9.		= 45 cm
10.		= 50 cm

1st month - 6-7 mm
2nd month – 2.5 cm

*CRL = crown-rump length

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Fetal position in utero

During fetal development, fetus is placed in amniotic sac, which is filled with amniotic fluid. The space of this sac decreases due to the growth of fetus. Therefore, fetus takes up the smallest possible volume, especially in the 3rd trimester.

Four characters of fetus arrangement in uterus are followed up and determined before delivery:

- *Situs*
- *Positio*
- *Praesentatio*
- *Habitus*

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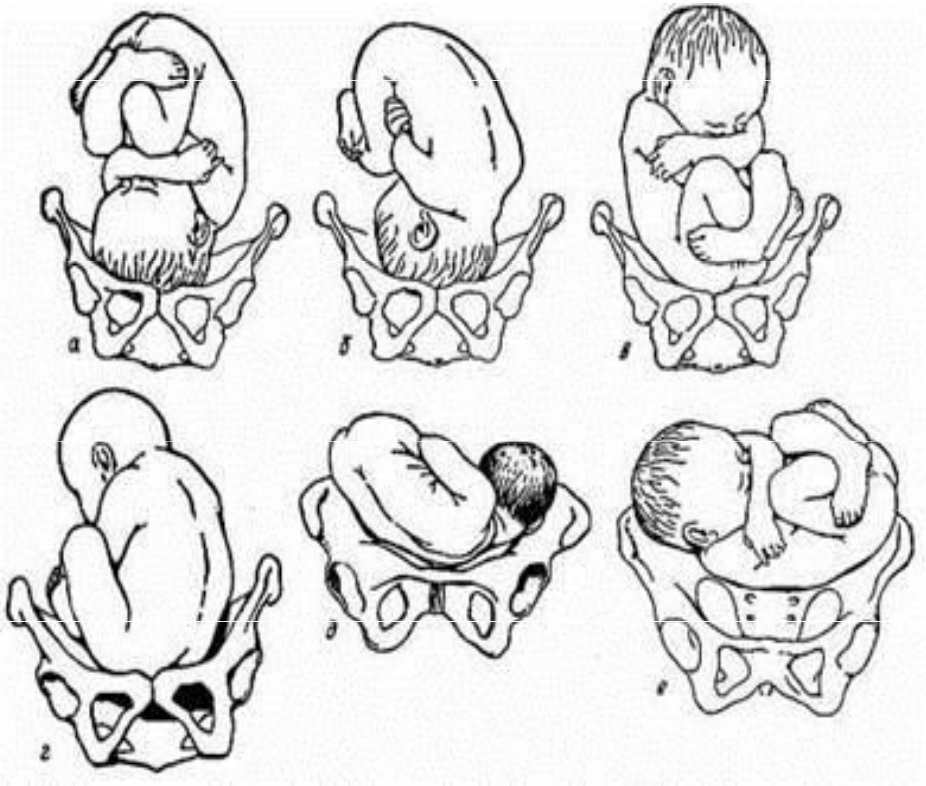
Situs

relation: long axis of fetus body – long axis of uterus

- longitudinal situs (parallel axes) - 99%
  by head (caudally) or by pelvis
- transversal situs
  (perpendicular axes) - 1%
- oblique situs - unstable,
  moves into longitudinal
  or transversal situs



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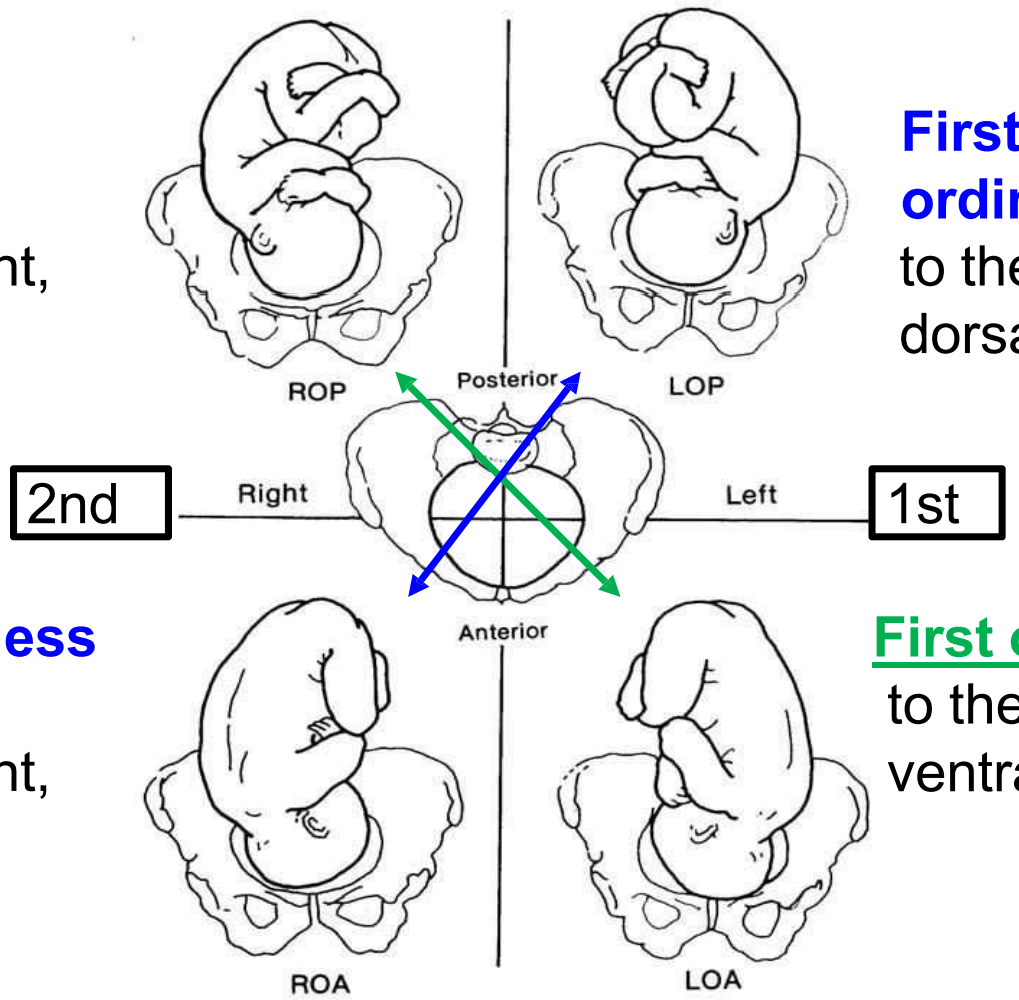
Positio

relation: back (head) of fetus – uterine margin

Second ordinary
to the right, dorsally

First less ordinary
to the left, dorsally



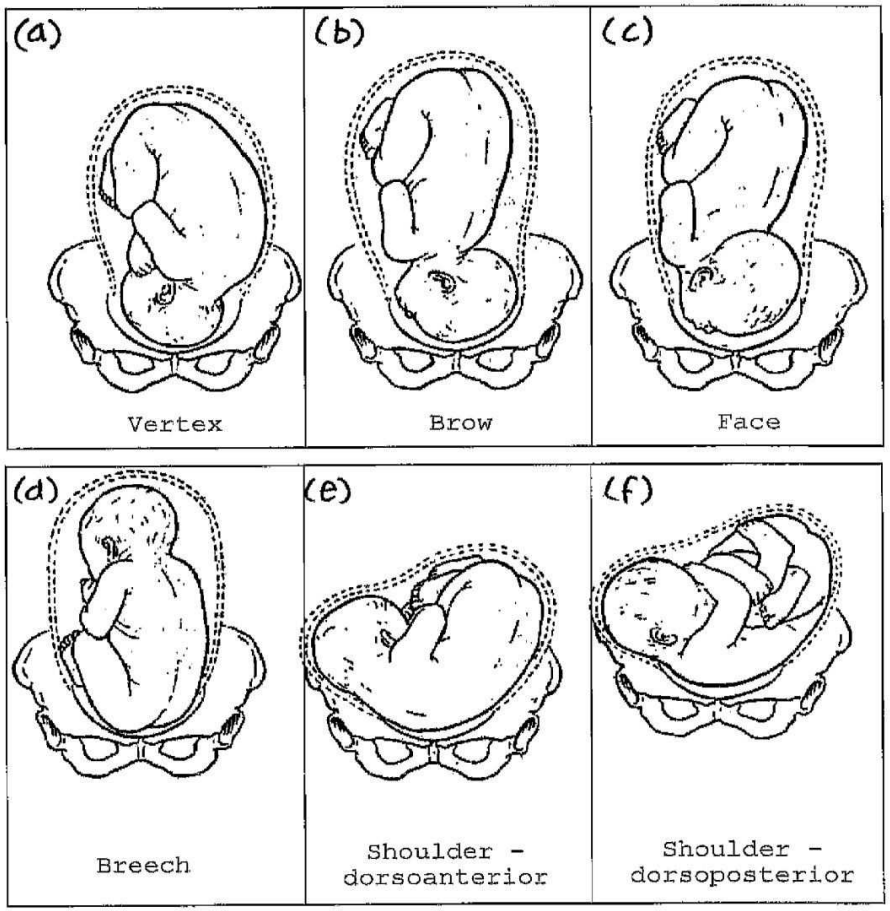
Second less ordinary
to the right, ventrally

First ordinary
to the left, ventrally

Praesentatio

relation: part of fetal body – aditus

- vertex (most frequent)
- forehead, face, occiput (1 %)
- pelvic end and feet
- trunk, shoulder



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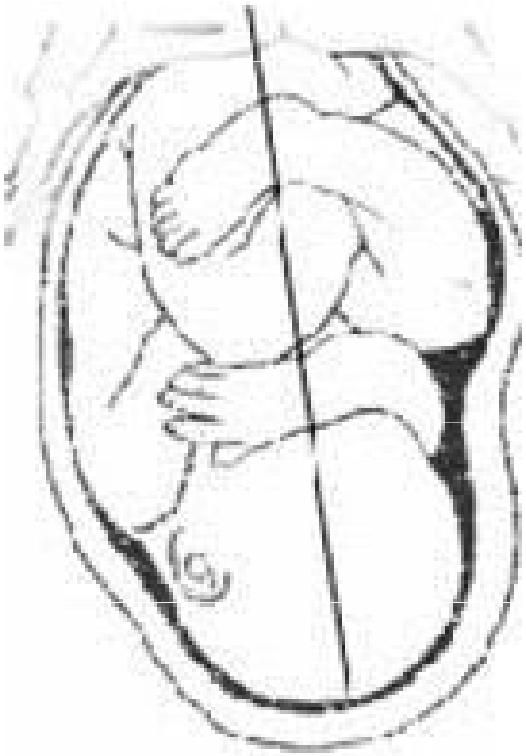
Habitus

relation: parts of fetal body to one another

- **regular**= flexion of head, chin on chest, limbs flexed in all joints, upper limbs crossed in front of the chest, lower limbs pressed to abdomen, fetus takes up *the smallest possible volume*
- **irregular** = each other



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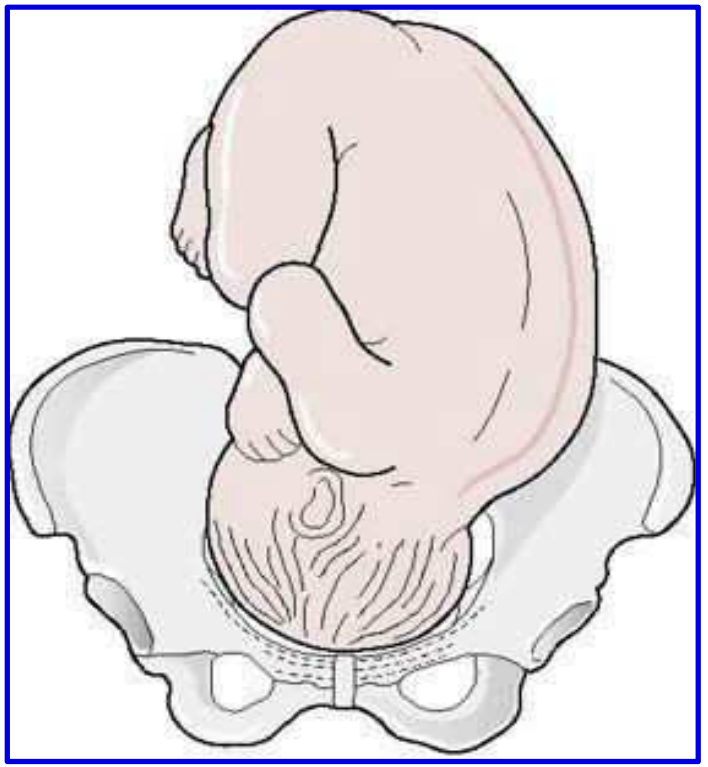
Physiological fetus position in uterus

- longitudinal **situs** by head
- first ordinary **position**
- **praesentatio** by head (vertex)
- regular **habitus**



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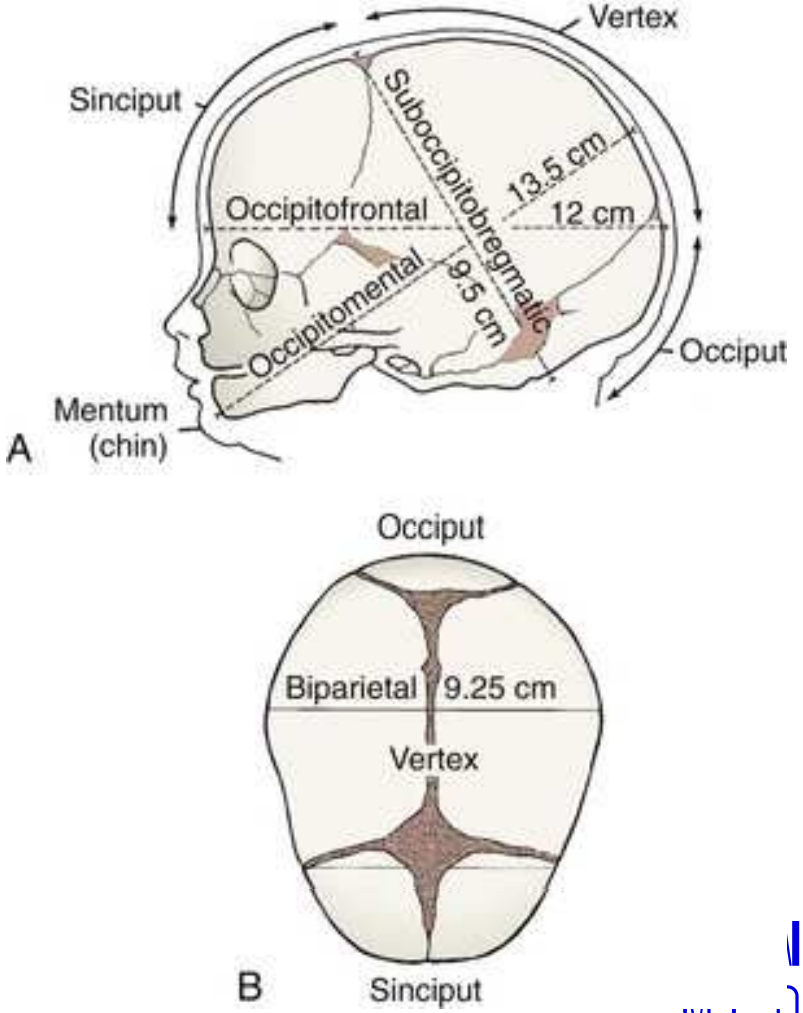
Marks of full-term fetus

Main characters

- length (50-51 cm)
- weight (3,000-3,500 g)
- diameters of the head in norm
- ♂ testes are descended in scrotum
  ♀ labia majora cover labia minora

Auxiliary characters

- fetus is eutrophic, subcutaneous fat is well developed
- skin – rests of lanugo on shoulders and back only
- eyelashes, brow, hair (several cm) are developed, nails overlap free end of fingers
- skull bones are hard, major and minor fontanelles are palpable and separated from each other
- newborn cries and moves



Mature and full-term fetus

- **Full-term fetus** – **relates to the length of pregnancy** (menstrual age):
  - **preterm** (to 37th week)
  - **full-term** (38 – 40 weeks)
  - **after term** (more than 42 weeks)

- **Mature fetus** – **relates to level of development**:
  - **mature**
  - **immature**

- **Level of nutrition**
  - **hypotrophic**
  - **eutrophic** (weight 3,000 – 3,500 g, length 50 - 51 cm)
  - **hypertrophic**

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GENERAL EMBRYOLOGY 2

- Set of embryological schemes II
- Atlas of Cytology and Embryology – pages 76 – 81

- Discussion
- 3 embryological schemes