GENERAL EMBRYOLOGY 2

• Development of extraembryonic structures – extra-embryonic 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, presentatio 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.
Extraembryonic mesoderm

- Derives from cytotrophoblast
- cells fill cavity of blastocyst („sparse mesh“)
- by fusion of clefts among cells - extraembryonic coelom between 2 layers of mesoderm (visceral and parietal) arises
Parietal layer =
extraembryonic somatopleura
+ cytotrophoblast – chorion
+ amnionic ectoderm – amnion

Visceral layer =
extraembryonic splanchnopleura
is mesoblast of yolk sac
(Heuser’s membrane)
Yolk sac, amnionic sac, fetal membrane - amnion, chorion.

cytotrophoblastic buds
extraembryonic coelom
chorionic cavity
neural tube
connecting stalk
extraembryonic somatopleura
extraembryonic splanchnopleura
chorion and chorionic villi
skin navel
CHORION = cytотrophoblast + syncytiotrophoblast + extrembryonic mesoderm
AMNION = extraembryonic mesoderm + ectoderm

GROWTH OF AMNIOTIC AND CHORIONIC CAVITY

Decidua capsularis

Chorion laeve
Chorionic Cavity
Amniotic cavity

Decidua basalis
Chorion frondosum

4 weeks embryo
8 weeks embryo

Decidua marginalis
Development of fetal membranes

- primitive gut
- neural tube
- chorionic villi
- connecting stalk
- amniotic cavity
- chorionic cavity
- chorion laeve
- chorion frondosum
• Villi choriales are based over the whole surface of implanted blastocyst, resp. Its chorionic membrane

• Different growth of villi toward **decidua basalis** (partially decidua marginalis) and **toward decidua capsularis and decidua marginalis** causes division of chorion into parts:

  • ➔ **CHORION FRONDOSUM** (toward decidua basalis – with villi) and

    ➔ **CHORION LAEVE** (smooth, without villi)

• Chorion frondosum and **decidua basalis** fuse together and creates **placenta**
Development of chorionic villi:

• chorionic villi – consist of **cytotrophoblast**, which is covered with **syncytiotrophoblast** (day 10)

• chorionic villi – with **extraembryonic mesoderm** ingrowing from chorionic cavity (day 12-13)

• chorionic villi – with extraembryonic **blood vessels** in mesoderm /vascularized mesoderm/ (day 17-18)
Human placenta
- discoidea
- olliformis
- hemochorialis

Ø 15 - 25 cm
width up 3 cm
weight 500g
FULL TERM PLACENTA

maternal surface (with cotyledons)

umbilical
1 vein +
2 arteries

materna surface
fetal surface

Decidua basalis
Kotyledony

Pupečník

Umbilikální cévy
(provitají skrze amnon)

Pupečník
COMPARTMENTS OF PLACENTA:

- **PARS FETALIS PLACENTAE** – chorionic plate + chorionic villi, intervilous space
- **PARS MATERNA PLACENTAE** = zona functionalis deciduae basalis
POSITION OF PLACENTA IN UTERUS

1. vental/dorsal wall
2. lateral wall
3. Postranní
4. Středová
5. uterine fundus

PLACENTA PRAEVIA
Anomalies of placenta

Anomalies of chorionic villi (1 : 100 pregnancies)

- mola hydatidosa
- chorionepitheliom

Anomalies in location:

- placenta praevia (causes bleeding in week 28)
- placenta accreta (attached to myometrium)
- placenta increta (grown into myometrium)
- placenta percreta (grown through myometrium)
Anomalies of placenta

- placenta membranacea (large, thin)
- placenta fenestrata (perforated)
- placenta tripartita (several portions)
- placenta succenturiata (1 main + several accessory placentae)

- placenta duplex
  (several separate pieces)

- placenta triplex

Diagram showing different types of placentas.
• Umbilical cord of full-term fetus: 50 – 60 cm long and 1,5 – 2 cm wide

⇒ amniotic ectoderm on the surface
⇒ jelly-like connective tissue with umbilical vessels: v. umbilicalis (1) + aa.umbilicales (2)
Anomalies of umbilical cord

- short (< 40 cm)
- long (> 60 cm)  
  \(\text{(danger of strangulation or formation of true knots)}\)
- true and false knots
- absence of 1 umbilical artery \(\text{(hypotrophfic fetus)}\)
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

Diagram:
- Amniotic cavities
- Chorionic cavities
- Placenta
**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 is 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 same sexes

<table>
<thead>
<tr>
<th>Type of Twins</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dizygotic</td>
<td>65%</td>
</tr>
<tr>
<td>Monozygotic</td>
<td>34%</td>
</tr>
<tr>
<td>Monozygotic</td>
<td>1%</td>
</tr>
</tbody>
</table>

TWINS diagram with stages of development.
MONOZYGOTIC separated on stage of 2 blastomeres

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

- Embryoblast divided into 2 cell clusters before creation of germ disc
- Trophoblast does not divide, remains common
- Fetal membranes: separate amnion (diamniotic), common chorion (monochorional) 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 (**monochorl, monoamniotic**)
- conjoined „Siamese“ twins develop in case of incomplete separation

TWINS

dizygotic

monzygotic

common amnion, chorion, placenta
Length of pregnancy

Fertilization
week 0 3 8 38 weeks = 266 days

CONCEPTIONAL AGE

1st day of last menstruation
0 1st day of last menstruation

MENSTRUAL AGE
40 weeks = 280 days = 10 lunar months

Preembryo
Embryo
Fetus

Calculation of the expected date of delivery:
Date of th 1st day of the last menstruation + 9 calendar months + 7 days
## Rule of Hasse

determine the age of fetus according its length

<table>
<thead>
<tr>
<th>AGE (l.m.)*</th>
<th>CRL** (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>(3^2) (\text{the second power of l.m.})</td>
</tr>
<tr>
<td>4.</td>
<td>(4^2)</td>
</tr>
<tr>
<td>5.</td>
<td>(5^2)</td>
</tr>
<tr>
<td>6.</td>
<td>(6 \times 5) (\text{l.m. } \times 5)</td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
</tr>
</tbody>
</table>

* l.m. = lunar month

** CRL = crown-rump length
Fetal position in utero

During fetal development, fetus is placed in amnionic sac, which is filled with amnionic fluid. Space of this sac decreases due to 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
• Habitus
• Presentatio
Situs
relation: long axis of fetus body – long axis of uterus

- **Longitudinal situs** (parallel axes) - 99%, by head (kaudally) or by pelvis
- **Transversal situs** (perpendicular axes) - 1%
- **Oblique situs** - unstable, moves into longitudinal or transversal situs
Positio

Relation: back [head] of fetus – uterine margin

Second ordinary
- to the right, dorsally
- to the right, ventrally

First less ordinary
- to the left, dorsally
- to the left, ventrally

Second less ordinary
- to the right, ventrally

First ordinary
- to the left, ventrally
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 the chest, lower limbs pressed to abdomen, fetus takes up the smallest possible volume
- **irregular** = each other
Praesentatio
relation: part of fetal body – aditus pelvis

- vertex (most frequent)
- forehead, face, occiput (1 %)
- pelvic end and feet
- trunk, shoulder (při poloze příčné)
Physiological fetus position in uterus

- Longitudinal situs by head
- First ordinary position
- Regular habitus
- Presentatio by head (vertex)
• Full-term fetus – relates to the length of pregnancy (menstrual age)
  - preterm (to 37th week)
  - full-term (38 – 40 week)
  - after term (more then 42 week)

• 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
Marks of full-term fetus

Main characters

• length (50-51 cm)
• weight (3,000-3,500 g)
• diameters of the head
• ♂ 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 bone are hard, major and minor fonticulus are palpable and separated from each other
• newborn cries and moves
EMBRYOLOGY

Set of embryological pictures II