

# Fetal envelopes and placenta

## Trophoblast development

As the fetus grows, its demands metabolism increase, which leads to changes in the placenta. In the second week, chorion branches into many secondary and tertiary villi, the surface of which is covered by syncytiotrophoblast, below it is cytotrophoblast, and the stroma of the villus is formed by vascularized mesoderm. Maternal blood is supplied to the placenta by spiral arteries, the wall of which is disrupted by the cytotrophoblast and the blood pours into the intervillous spaces between the villi. Cytotrophoblast cells disrupt the end sections of these arteries, replace endothelial cells and thus create a hybrid vessel that contains both maternal and fetal cells. Later, the trunk villi branch into free villi that grow from the sides into the intervillous spaces. After some time, the cytotrophoblast and the ligaments from their walls partially disappear, and the capillaries thus run just below the syncytiotrophoblast, so that only the syncytiotrophoblast layer and the vessel endothelium separate the fetal and maternal blood.

## Chorion frondosum and decidua basalis

As pregnancy progresses, the number and shape of individual villi of the chorion change. At the embryonic pole, they grow and expand, forming the so-called **chorion frondosum**, on the other hand, at the abembryonic pole, they degenerate and form the **chorion laeve**. The decidua in the region of the chorion frondosum, **decidua basalis** contains large cells rich in glycogen and lipids. The decidual layer at the abembryonic pole is **decidua capsularis**. capsularis and fuses with the **decidua parietalis**. Only the **chorion frondosum**, which together with the decidua basalis, participates in the formation of the **placenta**.

## The structure of the placenta

From the fourth month, we can distinguish two parts on the placenta: **pars fetalis**, formed by the chorion frondosum and **pars materna**, formed by the decidua basalis. On the fetal side there is the *chorionic plate*, on the maternal decidua basalis. Between them are intervillous spaces filled with maternal blood. During the fourth and fifth months, the decidua creates **decidual septa**, which divide the intervillous spaces incompletely, because they do not reach the chorionic plate. These septa divide the placenta into so-called **cotyledons**. The fetus grows, and the uterus and placenta expand with it. During pregnancy, the placenta covers roughly 15-30% of the inner surface of the uterus.



At the end of gravidity we talk about **placenta discoidalis**, because the placenta has the shape of a round target. It is about 3 cm thick in the middle and weighs 500-600 g. On its fetal surface, numerous large arteries and veins, chorionic vessels, converge to the attachment of the umbilical cord, which is located approximately in the center of the placenta.

Rarely its attachment is found in the area of the amniotic membranes, then we speak of **insertio velamentosa**

## Blood circulation in the placenta

The cotyledons are supplied by 80-100 spiral arteries that penetrate the decidual plate. Blood flows under pressure deep into the intervillous spaces and washes the small villi that branch into these spaces by growing from the trunk villi. As the pressure decreases, the blood reverses and flows back from the chorion to the decidual plate and enters the veins of the endometrium. The **placental membrane** that separates the blood of the mother from the blood of the fetus originally has layers:

- endothelium of fetal vessels,
- fibrous stroma of the villus,
- cytotrophoblast layer,
- syncytiotrophoblast.

Gradually, however, the ligament and cytotrophoblast are mainly thinned and broken down, whereby the endothelium comes into close contact with the syncytial membrane, and thus a higher degree of exchange of substances between the blood of the mother and the fetus is enabled.

## Function of the placenta

- **Exchange of metabolites and gases** - mainly oxygen and carbon dioxide through diffusion;
- **Transport of nutrients and electrolytes** - amino acids, free fatty acids, sugars, fats, vitamins;
- **Transfer of maternal antibodies** - immunoglobulin G (IgG);
- **Production of hormones** - progesterone, estriol, (during the first two months hCG, which maintains corpus luteum function) and somatomammotropin.<sup>[1]</sup>

## Fruit wrappers

**1. Amnion:** extraembryonic mesenchyme + amniotic ectoderm from epiblast.

It is the inner fruiting envelope which surrounds the amniotic cavity filled with amniotic fluid (recirculation approx. 1x in 3 hours). Premature rupture of the amnion causes premature birth, there is also a risk of ascending infection.

**2. Allantois:** the projection of the hindgut from the yolk sac towards the germinal shaft.

It is surrounded by primary mesoderm, in which the extraembryonic vessels of the umbilical cord are formed Fetal bladder connected to the allantois via the urachus.

**3. Chorion:** syncytiotrophoblast + cytotrophoblast + extraembryonic mesenchyme.

*Area with villi* is called the chorion frondosum, it is the chorionic plate at the embryonic pole towards to the decidua basalis.

Primary chorionic villi: the cytotrophoblast grows into the syncytiotrophoblast protrusions.

Chorionic villi secondary: extraembryonic mesenchyme penetrates the stroma of the villi.

Tertiary chorionic villi: extraembryonic blood vessels of the embryo are formed in the mesenchyme.

*Area without villi* is called the chorion laeve at the abembryonic pole below the decidua capsularis.

The chorionic cavity is a space in the extraembryonic coelom, it contains a yolk sac, at expansion of the amniotic cavity then the chorionic cavity disappears, the chorion fuses at the point of contact with the amnion and the amniochoric membrane is formed.

## Links

### related articles

- Placenta
- Placenta (histology)

### Sources

TONAR,, et al. *Plodové obaly. Amnion a jeho expanze, amniová tekutina. Chorion. Placenta. Růst zárodku a plodu. Porod* [online]. [cit. 2019-03-14]. <[http://www.lfp.cuni.cz/histologie/education/doc/outlines/4\\_plodove\\_obaly\\_placenta\\_rust\\_plodu.pdf](http://www.lfp.cuni.cz/histologie/education/doc/outlines/4_plodove_obaly_placenta_rust_plodu.pdf)>.

1. SADLER, Thomas, W. *Langmanova lékařská embryologie*. 1. české edition. Praha : Grada, 2011. 414 pp. ISBN 978-80-247-2640-3.