

# Ruminants

## Gestation Period

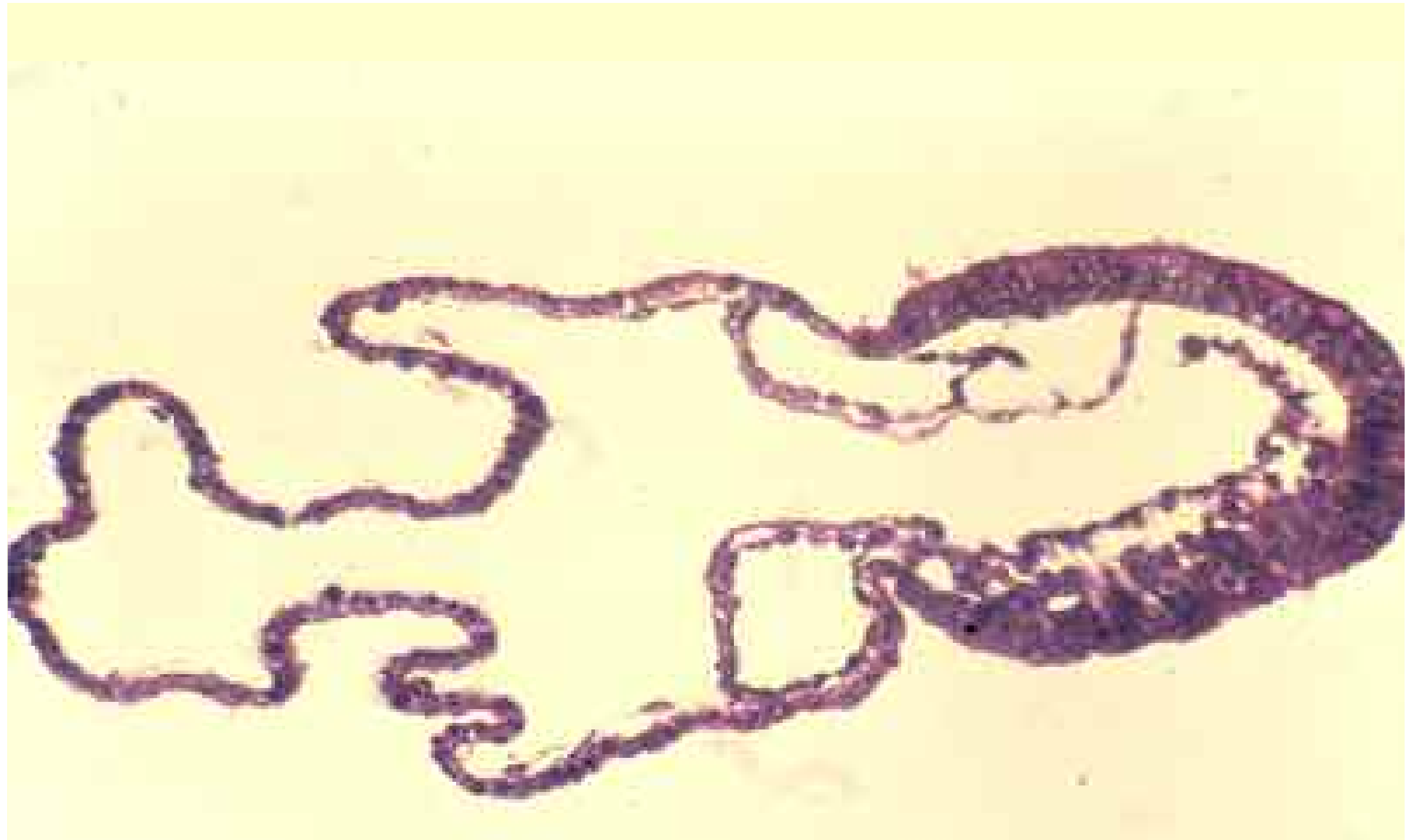
**In the cow 270 - 296 days (40 weeks or 9 months).**

**In the ewe 148 - 152 days (21 weeks or 5 months).**

**In the nanny goat 154 days (22 weeks or 5.5 months).**

## Placenta

**Classified as being chorioallantoic and chorio-amniotic, adeciduate, cotyledonary and epithelio-chorial**



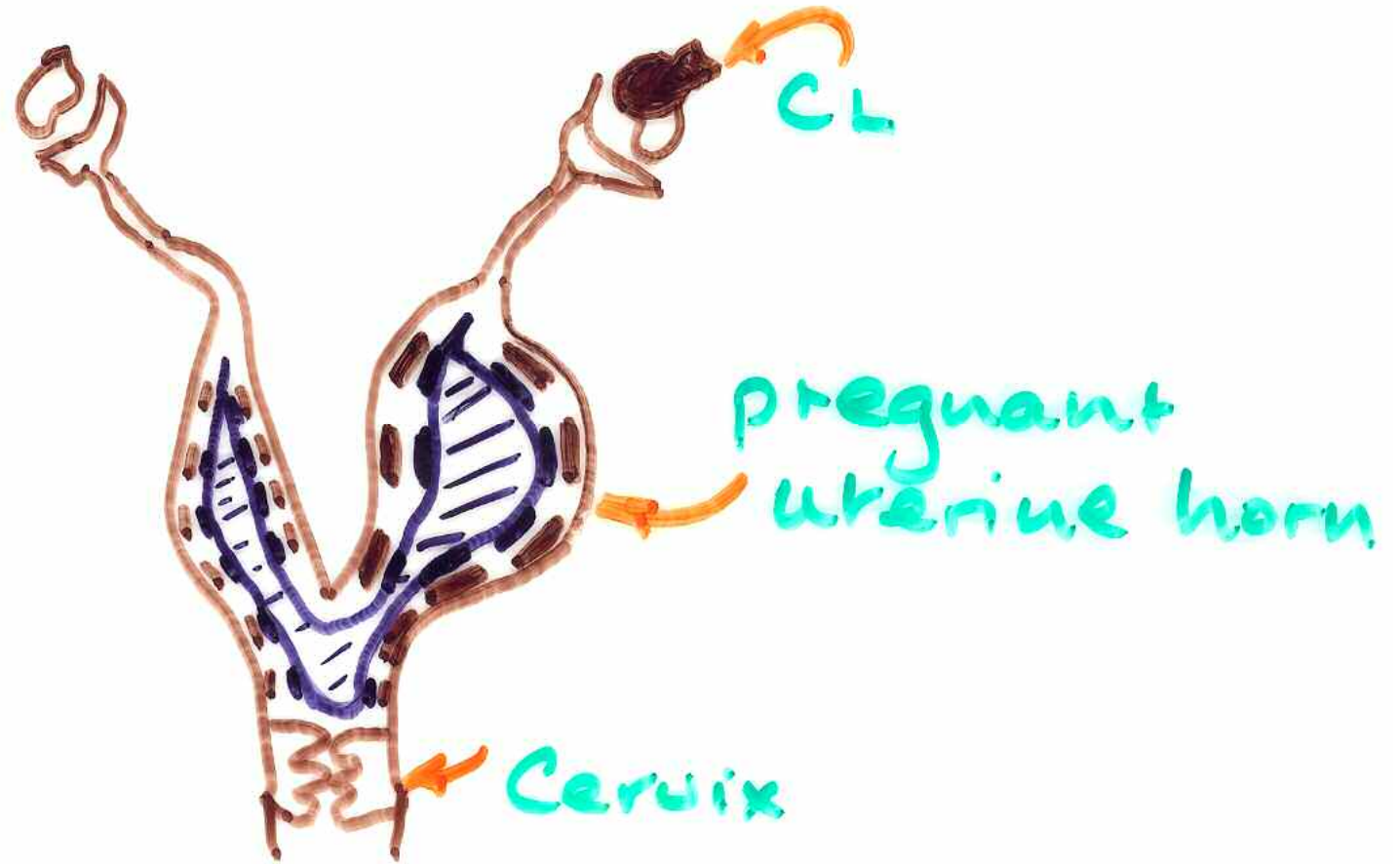
**Bovine embryo – 12 days**

# Ruminants

**Chorionic sac occupies uterine body and both uterine horns when fully developed. Pregnant horn shows dramatic growth.**

**Fetus usually develops in horn associated with ovary that ovulated**

**In cow, two out of three pregnancies occur in right horn – influence of rumen?**



5-7 d

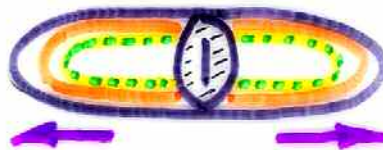


10-12 d

Entoderm completely grown around inside of trophoblast

12-13 d

Primitive Streak



2mm  $\phi$

17 d

primitive groove

50-60 cm



2-5 mm  $\phi$

(sheep 1 cm / hour)

20 d

long trophoblast shortens

- ① Atlantois
- ② collapse end pieces

## **Ruminant yolk sac**

**Narrow, elongated. Extends length of embryo. Soon regresses.**

**Vitelline circulation plays an early, limited role in uptake and transport of nutrients and oxygen.**

**Is responsible, however, for the production of blood vessels, blood cells and germ cells. Forms primitive gut.**

## **Ruminant amnion**

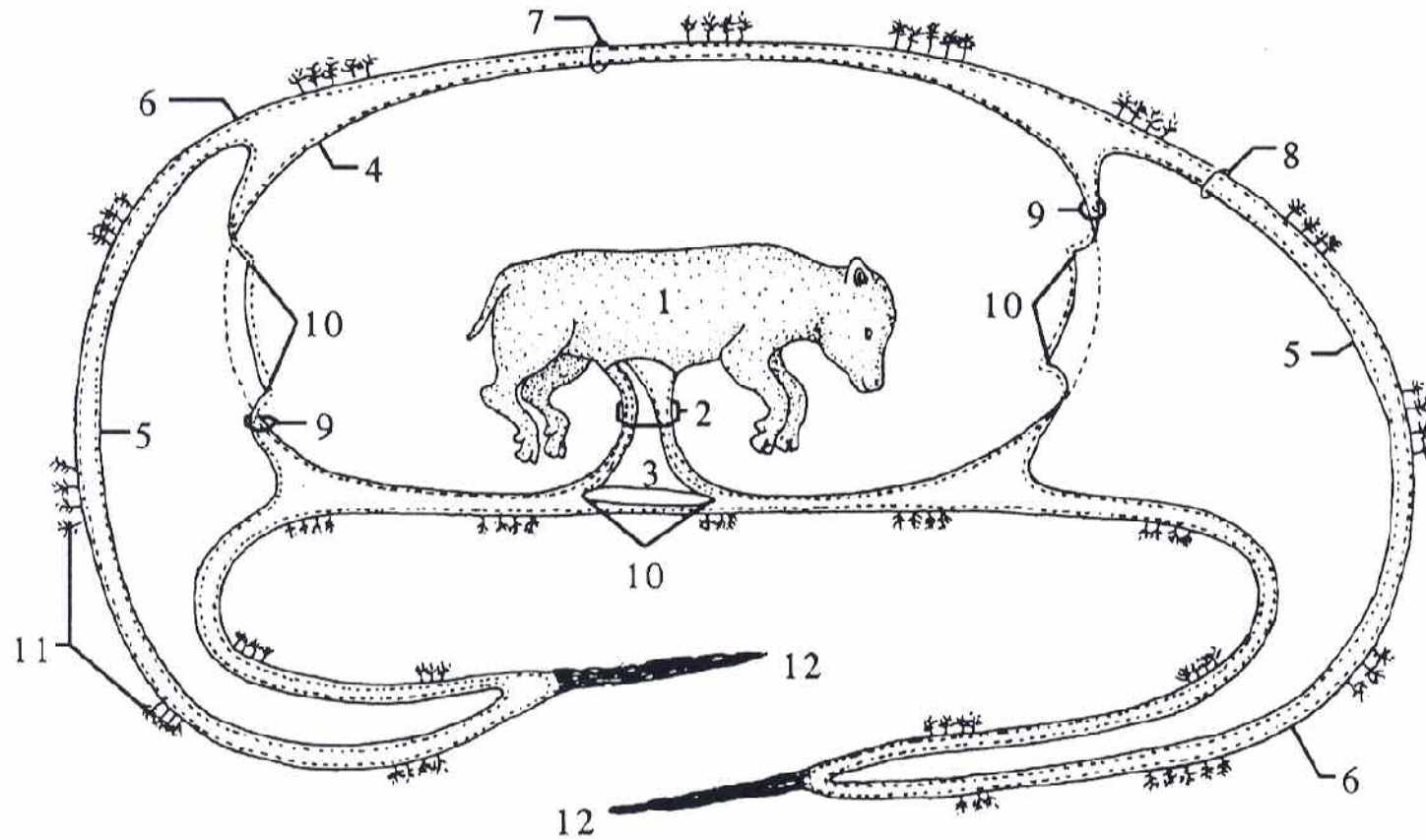
**Completely formed by week 2**

**Occupies the central portion of the chorionic sac except for a thin strip of allantois lying ventro-laterally.**

**Initially small amount of amniotic fluid which gradually increases in volume to 1-6 litres at parturition.**

**Amniotic plaques develop after about 3 months.**

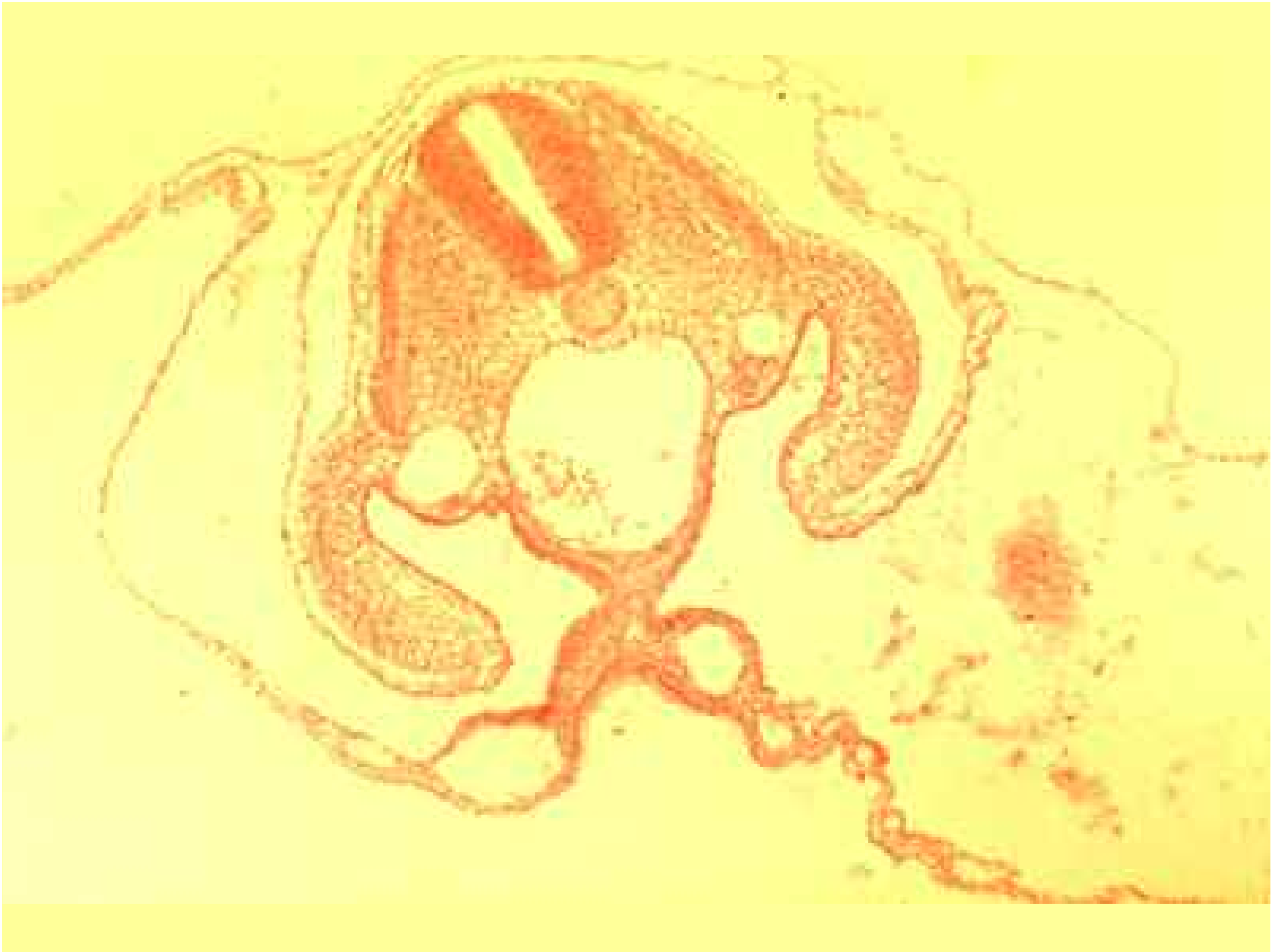
**Amniotic fluid is initially colourless but appears yellowish later. At partus it is thick and viscous – an excellent birth canal lubricant.**



- |                   |                   |                          |
|-------------------|-------------------|--------------------------|
| 1. Fetus          | 5. Allantois      | 9. Allantoamnion         |
| 2. Umbilical cord | 6. Chorion        | 10. Allantois transected |
| 3. Allantoic duct | 7. Amniochorion   | 11. Cotyledon            |
| 4. Amnion         | 8. Allantochorion | 12. Necrotic tip         |

**Fig. 2.24 Bovine conceptus (median section through fetal membranes, schematic)**





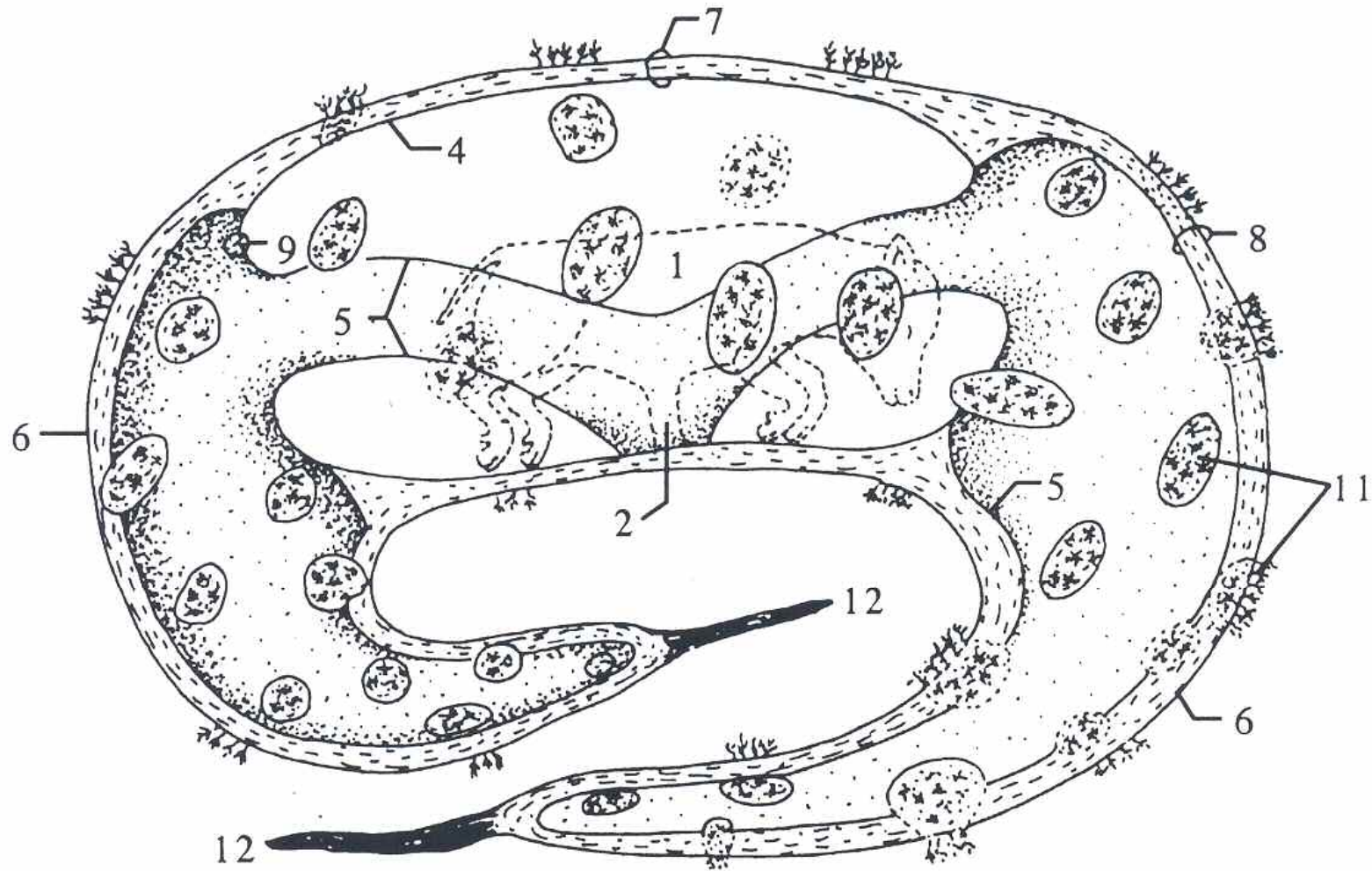


## **Ruminant allantois**

**Develops from about week 3 in bovine; slightly earlier in sheep. Evagination of hindgut. Grows ventro-laterally in a T-shaped fashion between amnion and chorion on right side of embryo. Expands to occupy extremities of chorionic sac. Splanchnic mesoderm containing umbilical Aa. And Vv. vascularises somatic mesoderm of amnion and chorion. Tips of chorionic sac are not vascularised – become necrotic.**

**Allantoic fluid: Hippomanes occur – Greenish in bovine, dirty white in goat**

**Volume at parturition is 3.5 – 12 litres in bovine, 0.7 – 1.1 litres in sheep.**



**Fig. 2.23 Bovine conceptus (right lateral aspect, schematic)**

**Legend as for Fig. 2.24 (below)**

## Ruminant chorion

**Placenta is formed by numerous focal areas of feto-maternal contact - Placentomes (70 – 140 in bovine; 80 – 100 in sheep; 160 – 180 in goat). Can be as large as 14 X 5 cm in bovine and 3 X 3 cm in sheep.**

**Placentomes consist of a cotyledon (fetal component) and a caruncle (maternal component)**

**Cotyledons consist of a mass of chorionic villi and are found on the allantochorion and amniochorion – not on the necrotic tips of chorionic sac.**

**Caruncles are nodular, epithelium covered, non-glandular masses of uterine connective tissue – permanent structures**

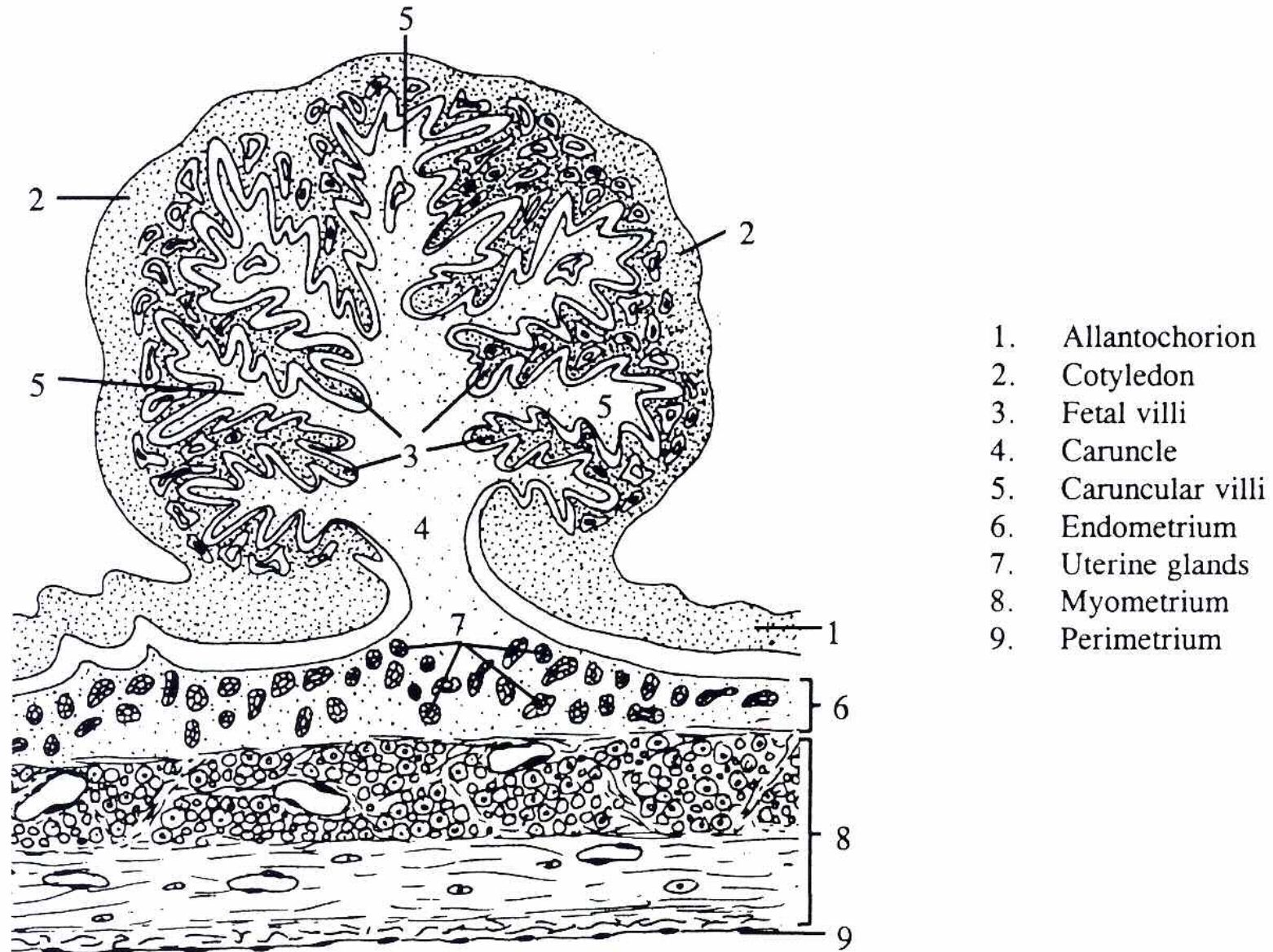
# Ruminant chorion

## Structure of Placentome:

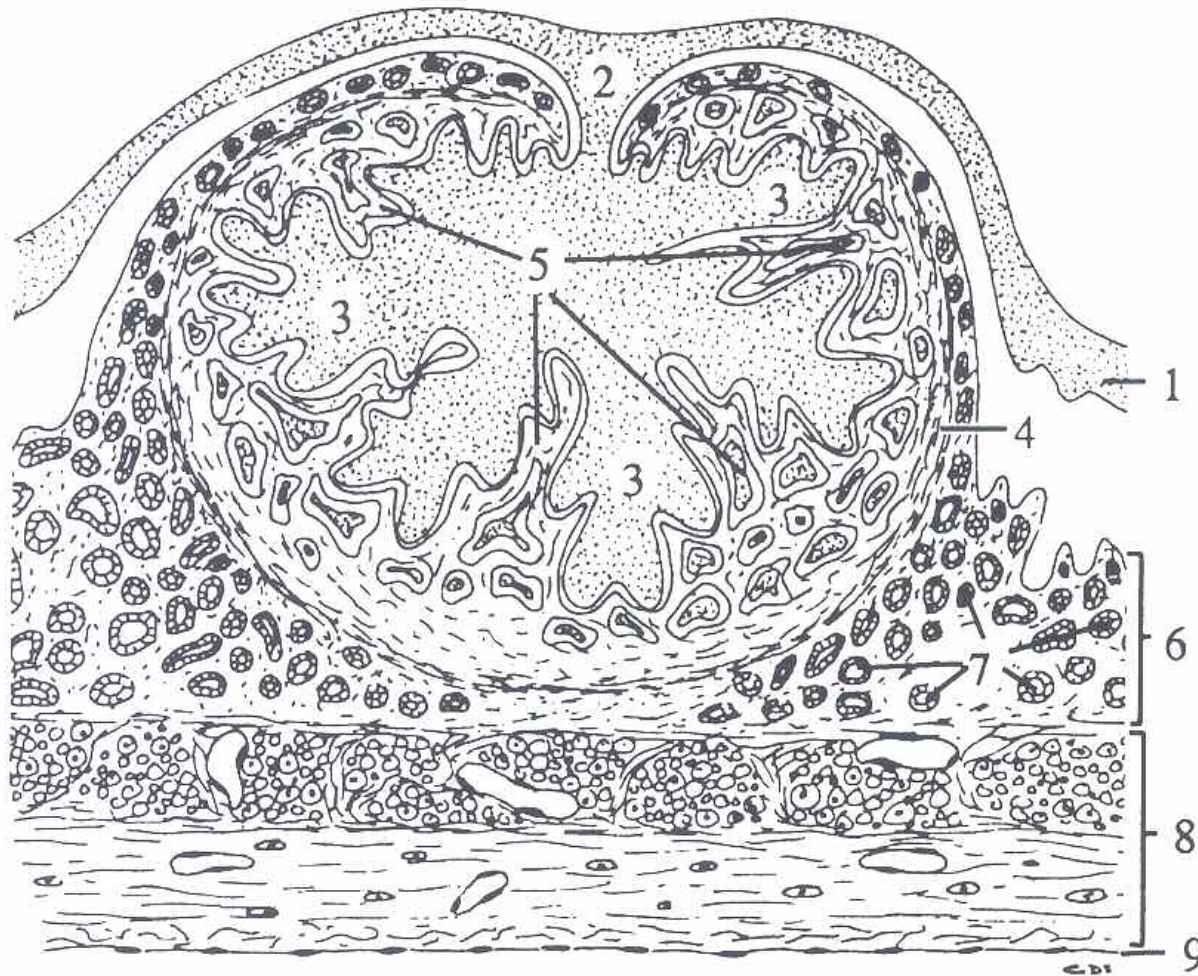
**Chorionic villi push into caruncle forming crypts. Villi become more complex and interdigitate with richly vascularised caruncular villi.**

**In bovine, caruncles are nodular and attached by stalk to endometrium; corresponding cotyledons are concave – cotyledon surrounds caruncle**

**In sheep and goat caruncles are concave and resemble cups, brim of cup forms lip; corresponding cotyledons are nodular and connected to chorion by a stalk – caruncle surrounds cotyledon. Caruncles deep in sheep, shallow in goat.**



**Fig. 2.25 Bovine placentome (transverse section, schematic)**



1. Allantochorion
2. Cotyledon
3. Fetal villi
4. Caruncle
5. Caruncular villi
6. Endometrium
7. Uterine glands
8. Myometrium
9. Perimetrium

Fig. 2.27 Ovine placentome (transverse section, schematic)



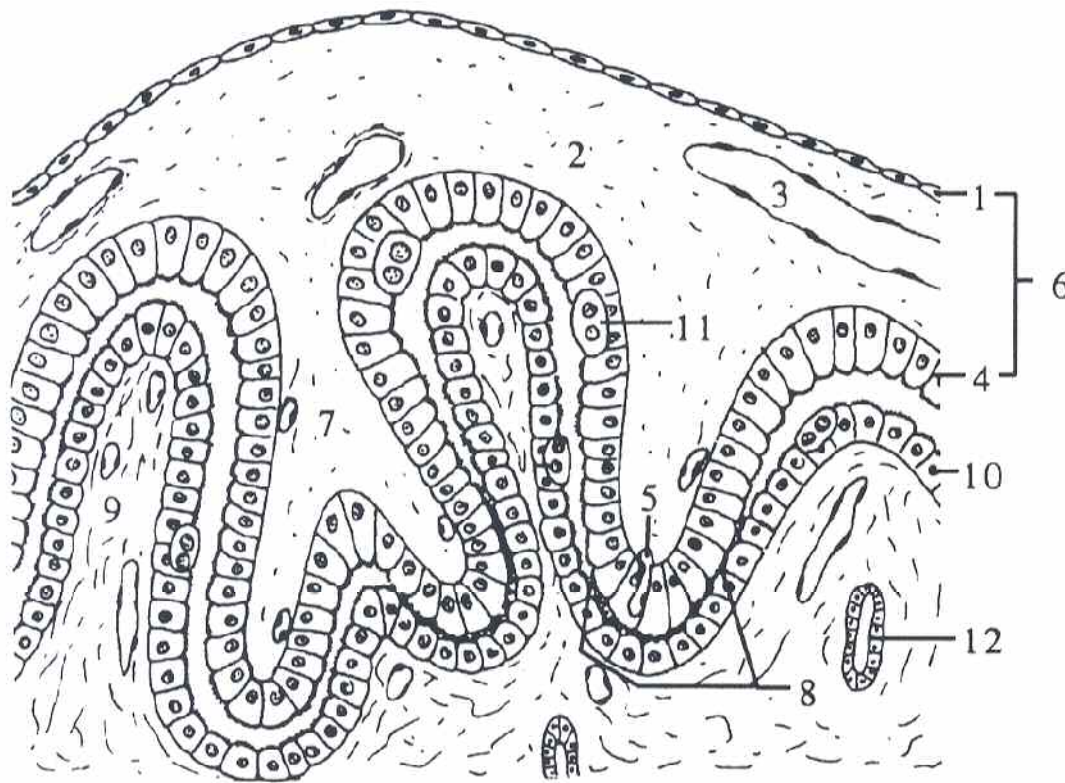
## **Ruminant chorion**

### **Embryotrophic Nutrition:**

**In the placentomes the tips of the chorionic villi are specialised for hemotrophic nutrition. Chorionic cells are cuboidal, have microvilli and intra-epithelial capillaries. Basal caruncular cells also have microvilli – intimate connection.**

**Base of chorionic villi specialised for histotrophic nutrition. Cells are columnar, have microvilli. Erosion of tips of caruncular villi provide histotroph in form of cell debris and blood cells. Hemorrhage rare in bovine – red blood cells supplied by diapedesis.**

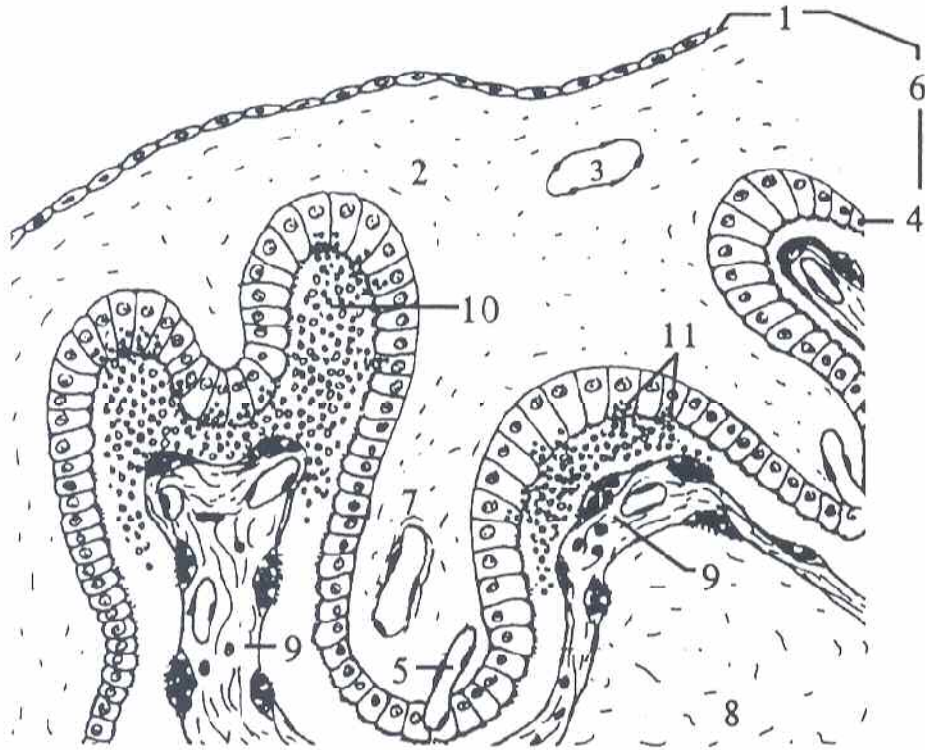
**In paraplacental areas (between placentomes) histotrophic nutrition occurs – uterine gland secretions plus sloughed epithelial cells.**



1. Allantois
2. Mesoderm
3. Remnant of exocoelom
4. Chorion
5. Intra-epithelial capillary
6. Allantochorion
7. Fetal villus
8. Interdigitating microvilli
9. Caruncular villus
10. Uterine epithelium
11. Giant cell
12. Uterine gland

Note: This figure does not correctly illustrate the columnar and cuboidal cells of the fetal villi.

**Fig. 2.26 Bovine placenta (histological section)**



1. Allantois
2. Mesoderm
3. Remnant of exocoelom
4. Chorion
5. Intra-epithelial capillary
6. Allantochorion
7. Fetal villus
8. Caruncular villus
9. Symplasma mass
10. Hemorrhage from tip of caruncular villus
11. Red blood cells ingested as histotrophe

Note: This figure does not correctly illustrate the columnar and cuboidal cells of the fetal villi.

**Fig. 2.28 Ovine placenta (histological section)**

# Ruminant chorion

## Miscellaneous information

- 1. Symplasma masses covering caruncular villi in sheep placentomes**
- 2. Migration of granular giant and binuclear cells in the bovine (at day 17)**
- 3. Development of adventitious caruncles in bovine only. They are small (2.5 cm diameter) and occur after day 120**

# Ruminant chorion

## Twins in Cattle

**Chorionic sacs lie against each other and fuse. Vascular anastomoses (fusion of blood vessels) form. In the case of heterozygous twins blood cell chimerism (cells with XX chromosomes and cells with XY chromosomes present in blood) results. Male animals rarely affected.**

**In females the Y-chromosome suppresses the development of the genital system → sterile heifer (Freemartin).**

**Freemartins develop in about 85% of heterosexual twin pregnancies. Freemartinism also occurs in sheep and goats.**

## **Ruminant umbilical cord**

**Relatively the shortest of the domestic animals.**

**Bovine and sheep: one quarter of fetal body length**

**Goat: one sixth of fetal body length**

**Amniotic plaques present. No allantoic component (see horse)**

**Umbilical veins fuse before entering umbilicus. Only left vena umbilicalis enters fetus.**



# Porcine

## Gestation Period

**In the sow 111 - 121 days (15.5 weeks or 3 months, 3 weeks and 3 days). Variations occur.**

## Placenta

**Classified as being chorioallantoic and chorio-amniotic, adeciduate, incompletely diffuse and epitheliochorial**



# Porcine

**More ova ovulated from left ovary than from right. Ova migrate and become evenly spaced in both uterine horns. Four viable embryos are required for continuation of pregnancy**

**As in the bovine there is early (day 11), rapid lateral elongation of the blastocyst. By day 17 it can be 1.5 m long and 2-5mm wide. The embryonal disc is centrally situated and the lateral extensions are folded concertina style.**

**Attachment to endometrium at about 3 weeks.**

## Porcine yolk sac

**Narrow, elongated. Extends length of embryo. Soon regresses.**

**Vitelline circulation plays an early, limited role in uptake and transport of nutrients and oxygen.**

**Is responsible, however, for the production of blood vessels, blood cells and germ cells. Forms primitive gut.**

## **Porcine amnion**

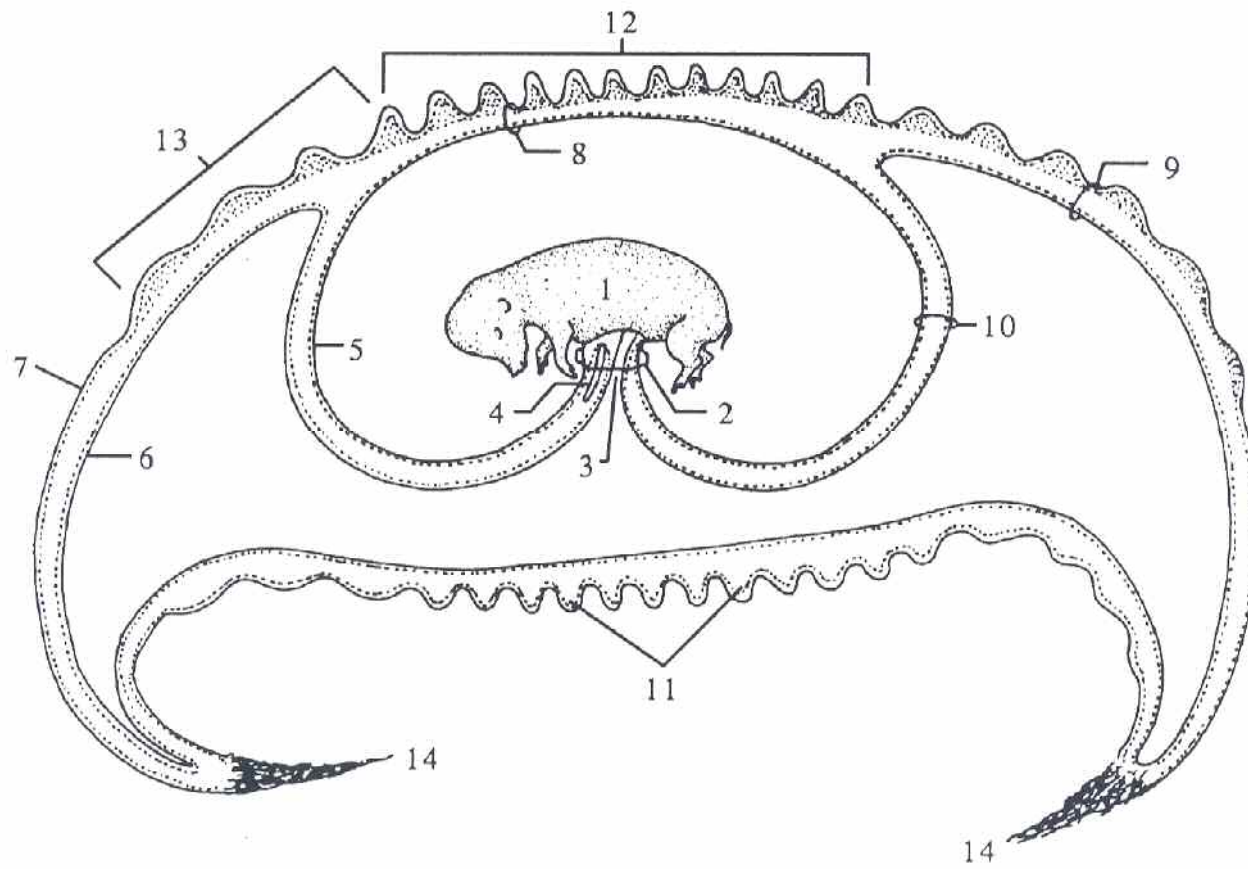
**Completely formed by day 18.**

**Occupies dorsal part of central portion of the chorionic sac. Vascularised by umbilical circulation.**

**Initially small amount of amniotic fluid which gradually increases in volume.**

**No amniotic plaques are formed.**

**Amniotic fluid is watery and slightly opaque.**



- |                       |                   |                        |
|-----------------------|-------------------|------------------------|
| 1. Fetus              | 6. Allantois      | 11. Chorionic ridges   |
| 2. Umbilical cord     | 7. Chorion        | 12. Placental zone     |
| 3. Allantoic duct     | 8. Amniochorion   | 13. Paraplacental zone |
| 4. Regressed yolk sac | 9. Allantochorion | 14. Necrotic tip       |
| 5. Amnion             | 10. Allantoamnion |                        |

**Fig. 2.31 Porcine conceptus (left lateral aspect, schematic)**

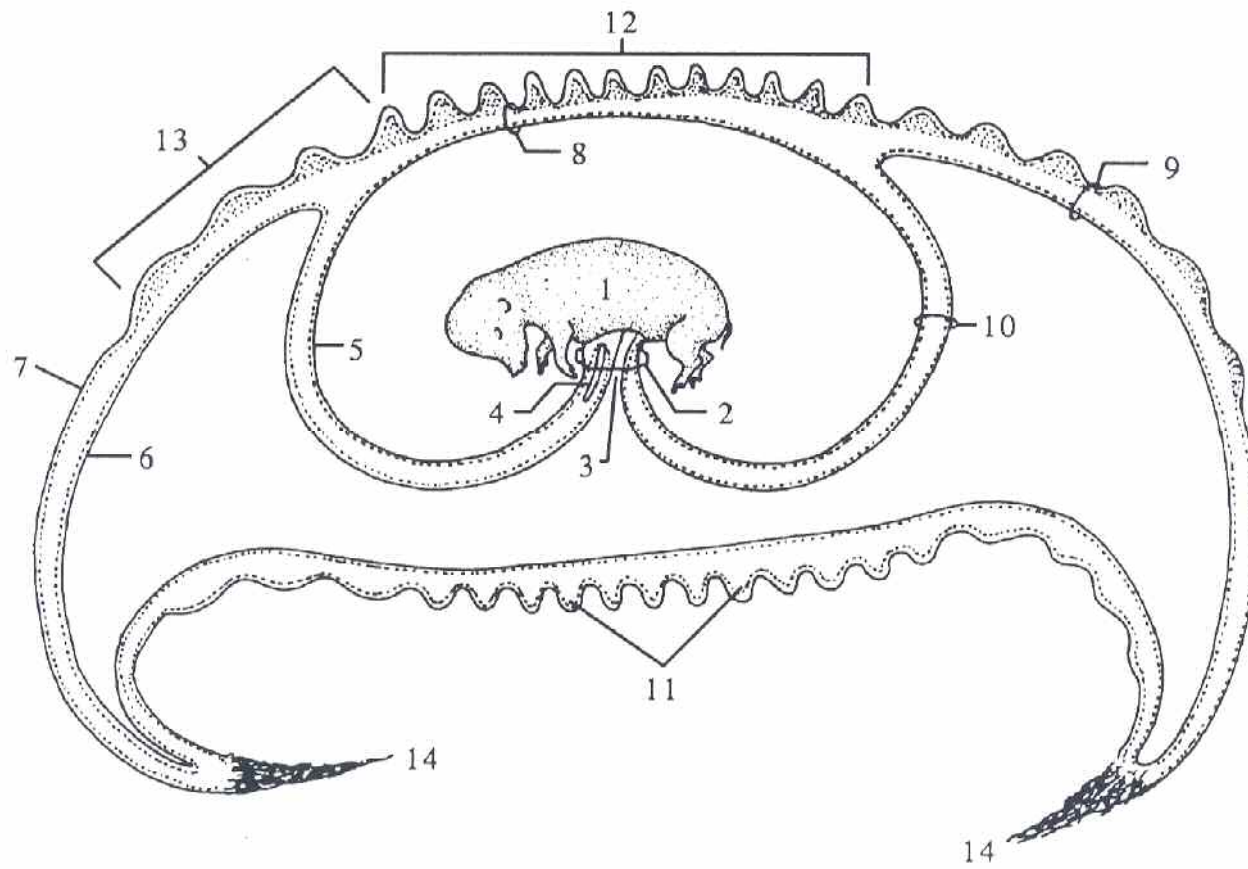
## **Porcine allantois**

**Develops from about week 2 as evagination of hindgut.**

**Forms two lateral extremities which fill the parts of the chorionic sac not occupied by the amnion (by day 24-25). It does not expand between amnion and chorion. Dorsal aspect of allantois fuses to ventral surface of amnion to form allantoamnion.**

**Umbilical circulation supplies allantochorion, allantoamnion and amniochorion, but not necrotic end tips**

**Hippomanes are occasionally found.**



- |                       |                   |                        |
|-----------------------|-------------------|------------------------|
| 1. Fetus              | 6. Allantois      | 11. Chorionic ridges   |
| 2. Umbilical cord     | 7. Chorion        | 12. Placental zone     |
| 3. Allantoic duct     | 8. Amniochorion   | 13. Paraplacental zone |
| 4. Regressed yolk sac | 9. Allantochorion | 14. Necrotic tip       |
| 5. Amnion             | 10. Allantoamnion |                        |

**Fig. 2.31 Porcine conceptus (left lateral aspect, schematic)**

## Porcine chorion

**Chorionic villi form from day 20 and extend over entire chorionic sac except for the necrotic end tips.**

**Chorionic sac develops transverse ridges from about 3 weeks – fit into corresponding furrows in endometrium.**

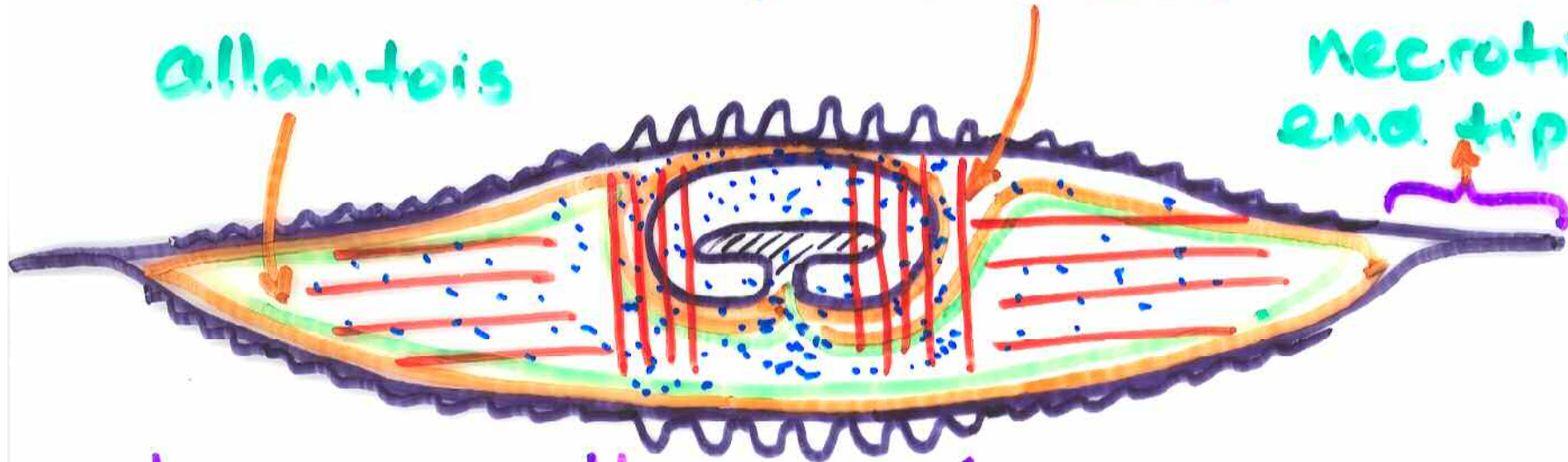
**Five zones:**

- (a) Placental zone in centre (well-developed ridges, villi, areolae and capillary network)**
- (b) Paraplacental zone X 2 (ridges, villi and areolae less well-developed; longitudinally arranged blood vessels)**
- (c) Necrotic end tips X 2 (no ridges, villi, areolae, blood vessels)**

(umbilical)  
b/v transverse

allantois

necrotic  
end tips



Para-placental zone

Placental zone  
with well developed chorion folds



# Porcine Chorion

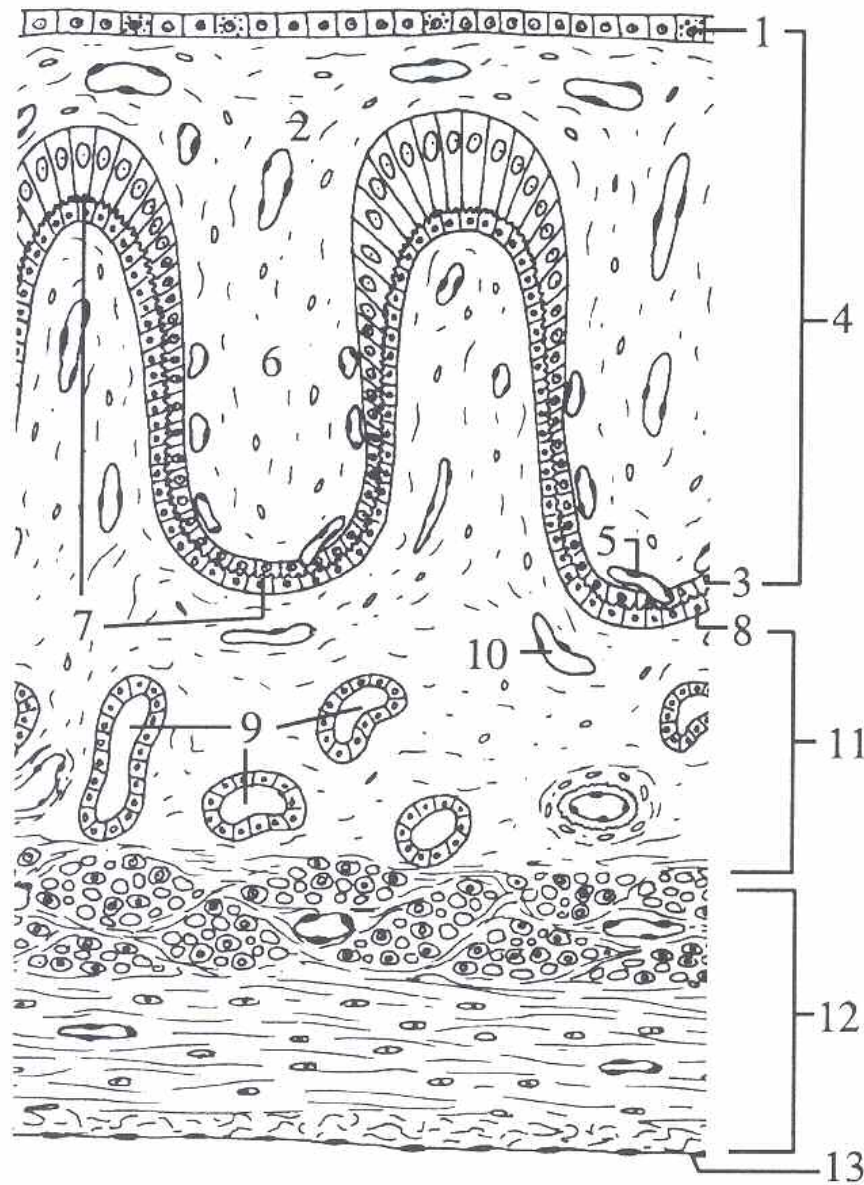
## Embryotrophic nutrition

**Tips of chorionic ridges and villi covered by cuboidal epithelium which displays intra-epithelial capillaries – chiefly responsible for hemotrophic nutrition.**

**Base of ridges and villi have columnar epithelium – histotrophic nutrition**

## Areolae

**Localised accumulations of histotroph (uterine gland secretions) lying in depressions of chorion opposite gland openings. Chorionic villi grow into areolae.**



1. Allantois
2. Mesoderm
3. Chorion
4. Allantochochion
5. Intra-epithelial capillary
6. Chorionic ridge
7. Interdigitating microvilli
8. Uterine epithelium
9. Uterine glands
10. Uterine capillary
11. Endometrium
12. Myometrium
13. Perimetrium

Fig. 2.33 Porcine placenta (histological section showing chorionic ridge)

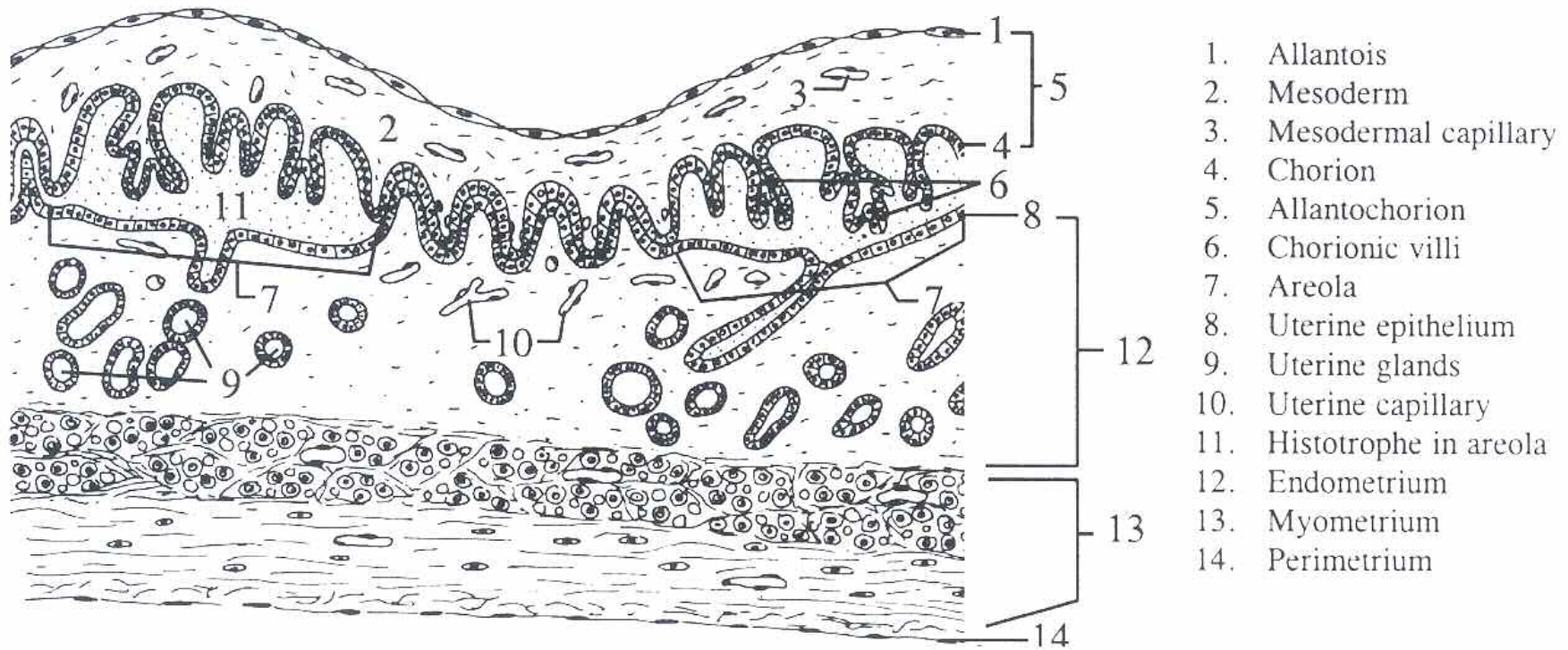


Fig. 2.34 Porcine placenta (histological section showing areolae)

## Porcine Chorion

**As gestation proceeds adjacent chorionic sacs eventually fuse at the paraplacental zones. Seldom vascular anastomoses – Freemartinism is rare.**

**At partus the amniochorion remains attached to the endometrium. Fetus ruptures amnion sac and fused paraplacental zone of chorion. Passes down fused chorionic sac.**

## **Porcine umbilical cord**

**Relatively the longest (25 cm) of the domestic animals.**

**No allantoic component (see horse). Covered only by simple squamous amniotic epithelium.**

**In later stages of development only left umbilical vein remains.**