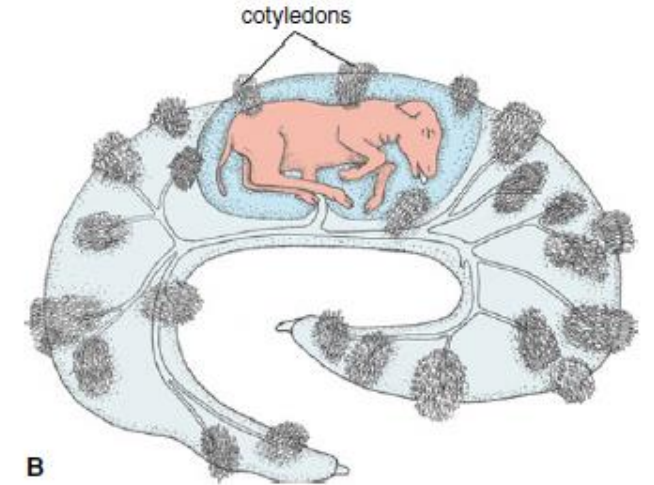
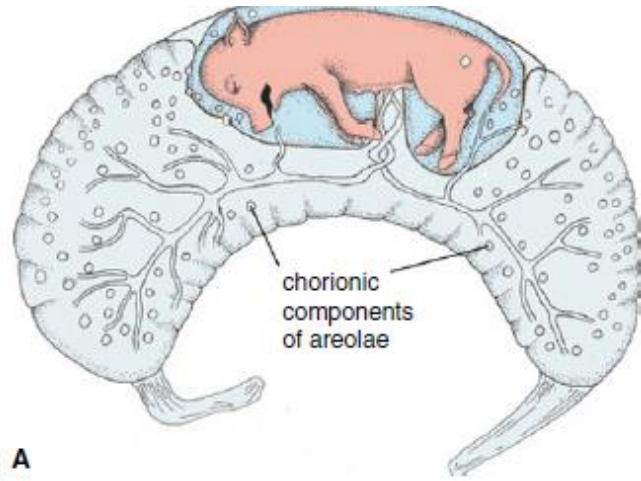


Forms of implantation and placentation

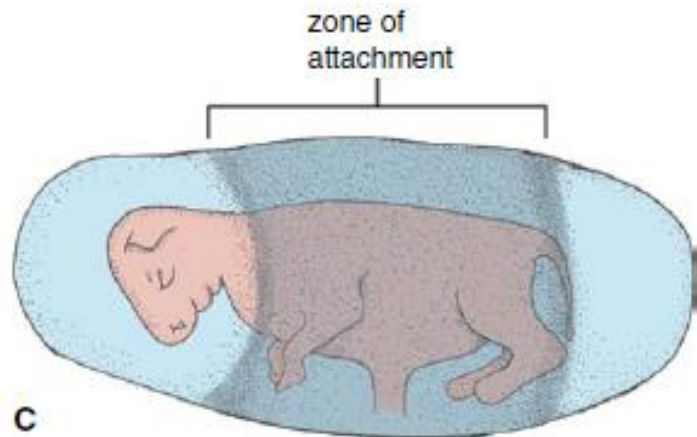
- **Implantation** is the term used to describe the attachment of the developing embryo to the endometrium. A placenta is subsequently formed.
- **The placenta** is an organ for physiological exchange of oxygen, carbon dioxide and nutrients between fetus and dam which acts as a selective barrier and as an endocrine organ.
- Placental classification is based on the shape, the number of fetal membranes contributing to the structure or the histological layers present.
- A transient choriovitelline placenta forms in domestic mammals; this is replaced by a definitive chorioallantoic placenta.

Classification of placentae based on the shape and the distribution of attachment sites of the chorion to the endometrium.

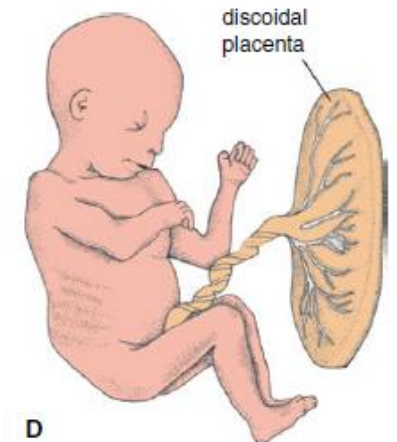
A. Diffuse form of placentation which occurs in horses and pigs. **B.** Cotyledonary form of placentation which occurs in ruminants.

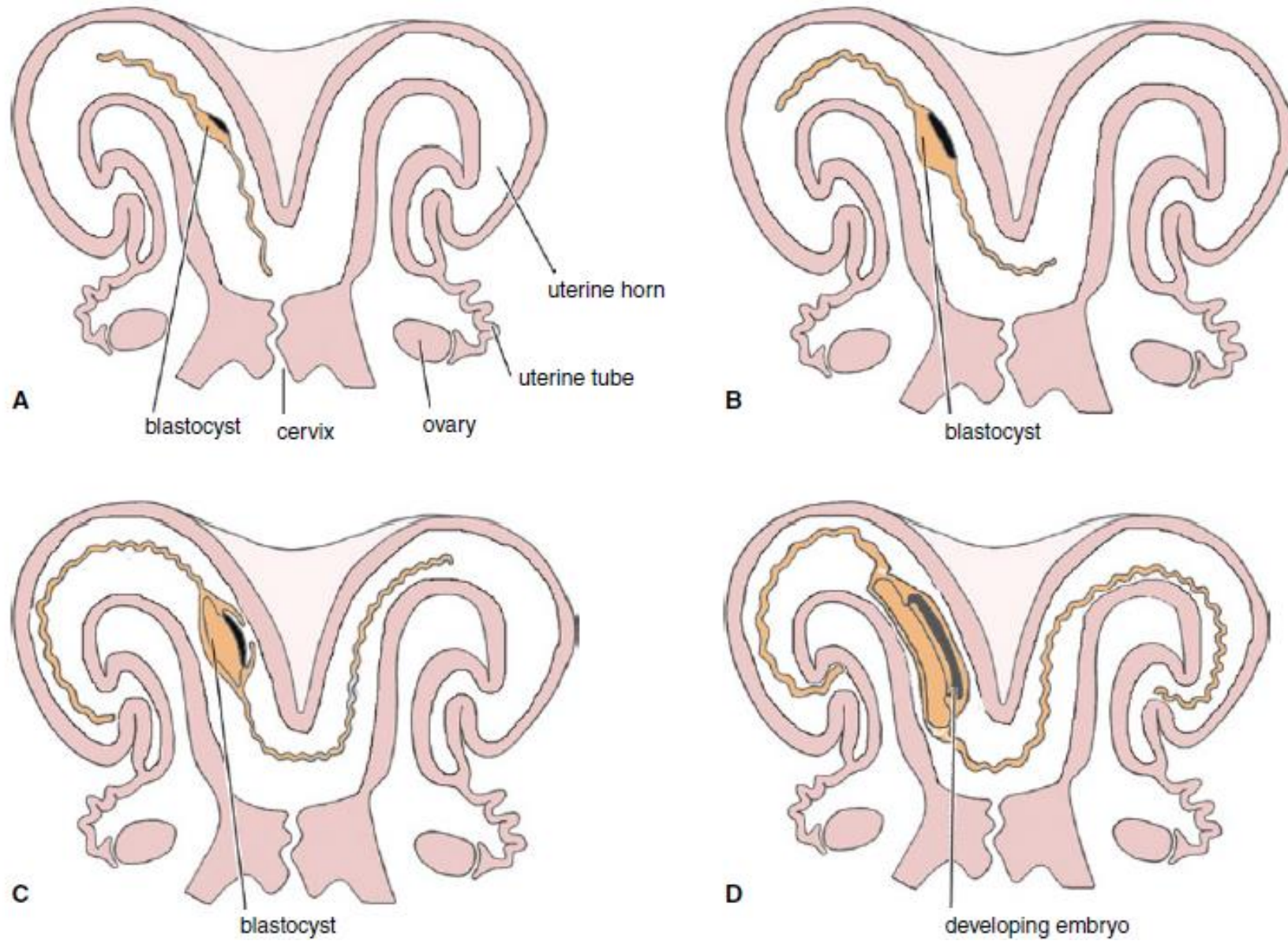


C. Zonary form of placentation which occurs in carnivores.

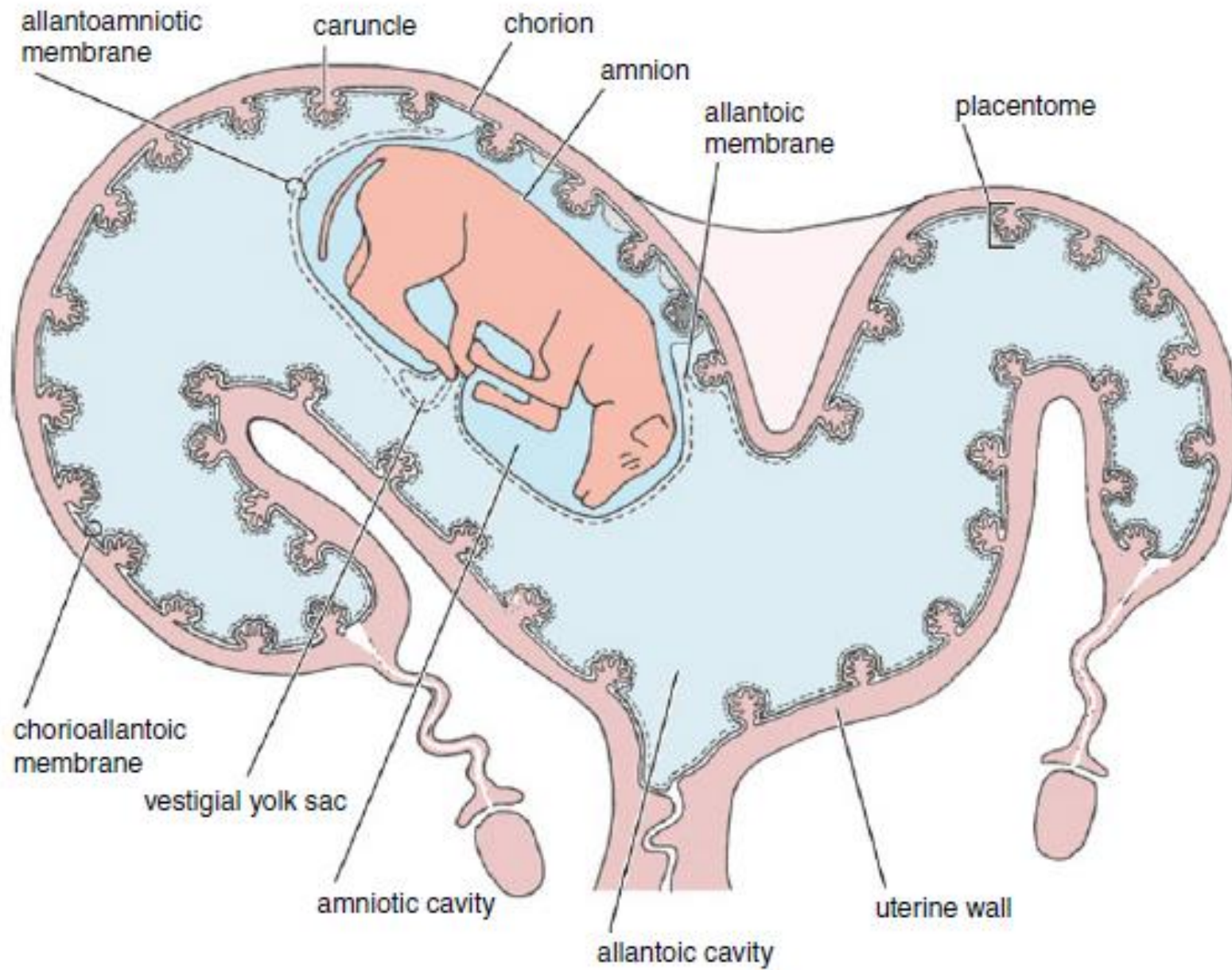


D. Discoidal form of placentation which occurs in humans, monkeys and rodents.





Sequential changes in the developing bovine blastocyst and its location in the uterus from the third to the fourth week of gestation, showing the marked elongation of the blastocyst and its extension into the non-pregnant horn (A to D).



Late stage in the process of implantation of a bovine fetus with clusters of chorionic villi interdigitating with maternal caruncles, forming placentomes..

Cardiovascular system

- The heart, blood vessels and blood cells develop from splanchnic mesoderm.
- The structures formed, the sinus venosus, atrium, ventricle and truncus arteriosus, differentiate into the chambers of the heart and great vessels (venae cavae, aorta and pulmonary trunk).
- The primordial heart elongates and bends, forming a cardiac loop, which develops into the four-chambered heart, characteristic of mammals and avian species.
- Formation of inter-atrial and inter-ventricular septa leads to inter-atrial and inter-ventricular partitioning. Inter-atrial septation is completed postnatally.
- Prior to birth, the placenta is the organ of gas exchange.
- The umbilical vein carries oxygenated blood to the fetus.
- The foetal atria communicate by means of a small opening in the inter-atrial septum, the foramen ovale, while the ductus arteriosus connects the pulmonary trunk to the aorta.
- The presence of these shunts means that most of the circulating blood avoids the non-functional fetal lungs.
- Blood vessels and lymphatic vessels both develop from splanchnic mesoderm.
- Both sets of vessels form by vasculogenesis and angiogenesis.

Muscular and skeletal systems

- Skeletal, smooth and cardiac muscle comprise the musculature of the body.
- Skeletal muscle is derived from the somitomeres and somites of paraxial mesoderm.
- The somitomeres form muscles of the head.
- The axial and limb musculature develop from somites.
- With few exceptions, smooth muscle originates from splanchnic mesoderm.
- Splanchnic mesoderm surrounding the developing heart tube gives rise to cardiac muscle.
- Skeletal tissues develop from several sources: the sclerotome, derived from somitomeres and somites, lateral plate mesoderm and neural crest cells.
- The sclerotomal cells form mesenchyme which differentiates into chondrogenic and osteogenic cells.
- Flat bones form by intramembranous ossification. In long bones, mesenchymal cells form hyaline cartilage templates, which are eventually replaced by bone (endochondral ossification).

Digestive system

- The primitive gut tube, which is derived from endoderm and extends from the oropharyngeal membrane to the cloacal membrane, is composed of the foregut, midgut and hindgut.
- Splanchnic mesoderm forms the smooth muscle and connective tissue of the alimentary tract. Neural crest cells give rise to the submucosal and myenteric plexus of the enteric nervous system.
- The cranial portion of the foregut gives rise to the oral cavity, pharynx and trachea.
- Derivatives of the caudal region of the foregut include the esophagus, stomach and proximal duodenum.
- The liver, pancreas and gallbladder are outgrowths of the caudal region of the foregut.
- A four-chambered stomach, adapted for fermentation, develops in ruminant species.
- The rumen, reticulum and omasum are the sites of microbial fermentation and absorption of nutrients.
- The abomasum is the glandular stomach where chemical digestion occurs.
- Most of the intestinal tract, from the proximal duodenal region to the transverse colon, develops from the midgut. Looping and rotation of the midgut leads to repositioning of the intestinal tract.
- The caecum and ascending colon, both midgut derivatives, are highly modified in horses, pigs and ruminants.
- The hindgut forms the distal part of the transverse colon and the descending colon

Respiratory system

- The laryngo-tracheal tube develops from an endodermal outgrowth of the ventral wall of the foregut.
- Laryngeal cartilages and associated musculature develop from pharyngeal arch mesenchyme.
- Two bronchial buds form at the bifurcated distal region of the laryngo-tracheal tube. These buds elongate and extend into the surrounding mesenchyme, forming bronchi and bronchioles.
- Terminal bronchioles give rise to respiratory bronchioles and alveolar ducts.
- Differentiation of the alveolar ducts leads to formation of alveolar sacs and alveoli.
- Development and differentiation of alveoli continues postnatally.