

#### Factors affecting the length of gestation period (G.P.):

- ☞ **Maternal factors:** The age of the dam influences the duration of pregnancy in different species.
  - Young heifers carry their calves for a slight shorter period than older heifers.
  - In sheep elder than 8 years, has extended gestation period by two days.
- ☞ **Hereditary (genetic) factors:** Every species of animal has its own nearly fixed gestation period, with small variation among breeds may be due to genetic, seasonal or local effects.

Animals	Gestation period (per days)
Cow:	273-296
Horse:	327-357
Sheep:	140-148
Swine	111-116
Dog	60-63
Cat:	56-65
Goat:	148-156
Rabbit	30-32
Egyptian buffalo	316-318
Camel, Bactrian	333-430
Dromedary	315-350
Elephant, Indian	615-650

#### Factors affecting the length of gestation period (G.P.):

- ☞ **Hereditary (genetic) factors:** Every species of animal has its own nearly fixed gestation period, with small variation among breeds may be due to genetic, seasonal or local effects.
  - Genotype of the fetus: hybrids between the horse and donkey, G.P. is close to paternal than maternal component of the fetus.
  - Transfer of embryo from breeds of shorter gestation length than the donor, makes the G.P. of recipient is shorter.

☞ The duration of gestation period is genetically determined, though it can be modified by

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	4- Environmental								

#### Factors affecting the length of gestation period:

- ☞ **Fetal factors:** An inverse relation between the duration of gestation and litter size is well documented in several polytocous species except the pig.
  - A- **Multiple fetuses** in monotocous species have shorter G.P., and twin calves are carried 3-6 days less than single calves.
  - B- **Sex of the fetus:** male calves and foals are carried 1-2 days longer than females.
  - C- **The endocrine functions of the fetus** may influence the length of pregnancy duration.
- ☞ **5- Pathological factors include:**
  - ☞ Factors increasing G.P. as mole, mummified fetus and uterine torsion.
  - ☞ Factors decreasing G.P. as trauma and diseases causing abortion as brucellosis, T.B.

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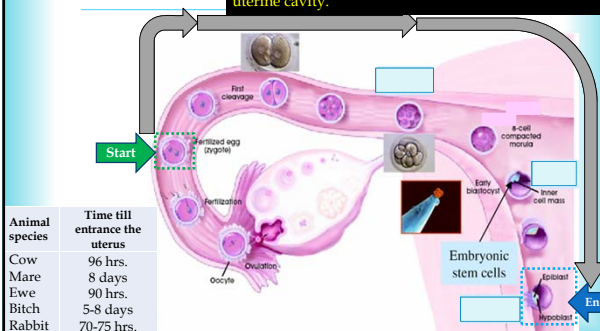
**Environmental factors:**

**Feeding:** well fed dam have shorter G.P. than under fed dams because of earlier time for their fetus to reach maturity than under fed one.

**Season of conception:** Animals giving birth in winter or spring will have short G.P. this is due to the fact that the fetal growth rate is accelerated during the last 3 months of pregnancy when the dam receiving green fodder rich in vitamins and minerals.

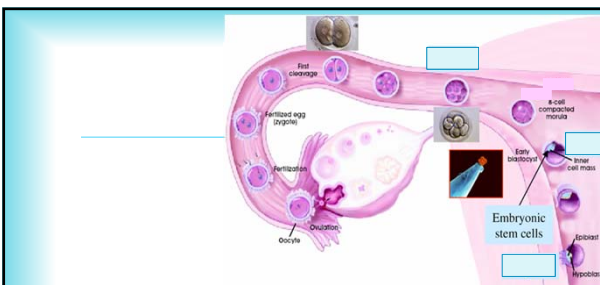
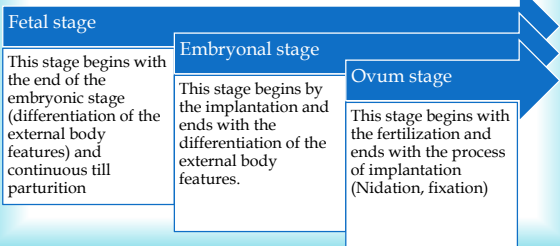
**1- Ovum stage or Germinal stage**

The main mechanisms responsible for the migration of the fertilized ovum to the uterus are:  
 1-Peristaltic movements of the fallopian tubes.  
 2-The ciliary movements of the cells lining fallopian tubes.  
 3-The continuous flow of the tubal fluid toward the uterine cavity.



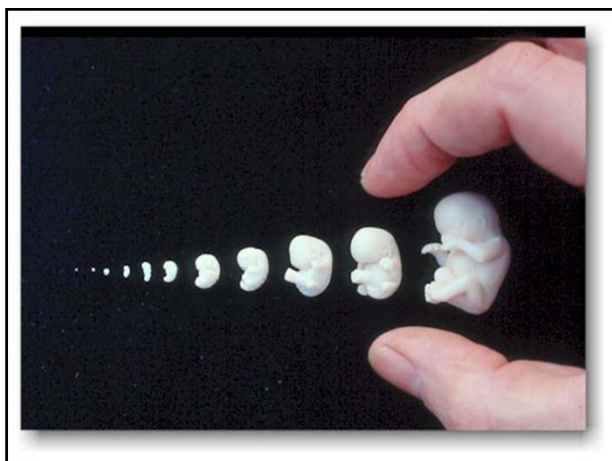
**What are the stages of gestation period**

according to the changes occurring in the conceptus (fetus): There are 3 successive evolutionary stages



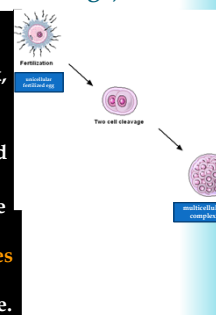
**Some changes occurring during germinal stage are:**

1. Transportation of the zygote from the site of fertilization (ampulla) to the uterine horn.
2. Division of the fertilized ovum (cleavage).
3. Nutrition of the zygote on the egg yolk and uterine secretion (uterine milk).
4. Orientation: the zygote migrate to the uterine wall (great curvature), where the process of implantation occur.
5. Implantation is the process by which the permanent connection between fetal and maternal circulation is established.



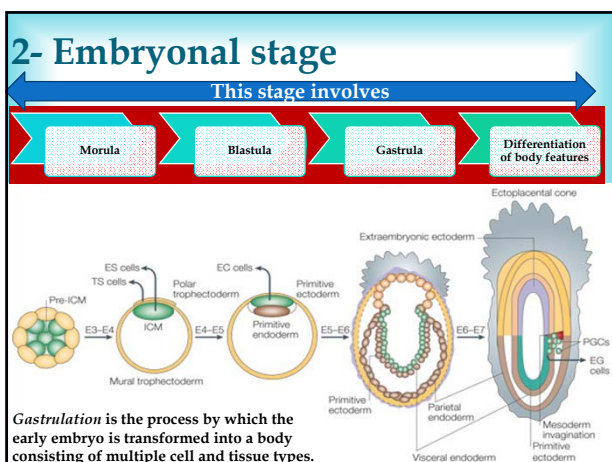
**The main features of this period (ovum stage) are:**

- The unicellular fertilized egg is converted by successive mitotic divisions into a multicellular complex, of the same bulk and shape.
- Transformation of the food resources into active cytoplasmic substances and nuclear substance.
- The ratio of the nuclear material to the cytoplasm, which begins very low at the beginning of the cleavage, becomes at a ratio similar to that found in the somatic cells at the end of the cleavage.



Species	Length of ovum stage
Cattle	12 days
Sheep	11 days
Mare	10-15 days





### 1. Organogenesis:

- The primitive streak represents the center for the body growth, through the rapid multiplication of the cephalic region of the body of the embryo.
- At the end of the third or the fourth week**, the primordial of the ears and eyes become recognizable.
- External body prominences start to be made by formation of the heart which lies far toward the head, directly below the chin.
- The growth of the trunk occurs in the form of the elongation of the body of the embryo.

The most important processes proceeding during this stage are:

- Organogenesis

### 1. Organogenesis:

development of the three germ layers into rudiments of organs.

### 1. Organogenesis:

- At the end of the fourth week**, another slight prominence is observed by the developing liver just behind the heart prominence and becomes separated from the later by a depression, which demarcates the place of the diaphragm.
- Caudal to the hepatic prominence is found the obvious belly stalk, through which the embryo is continuous with the extra-embryonic membranes. This stalk forms later on the umbilical cord.

### 1. Organogenesis:

- In mammals, birds and reptiles, the onset of gastrulation is marked by the formation of the *primitive streak* which recognized as a thickening of cells at the posterior (or tail) of the embryo. These cells move out to form a rod like structure that extends approximately three-fifths the length of the embryo. At the most anterior tip of the streak, a bulbous mass of cells known as *Hensen's Node* forms.

### 1. Organogenesis:

- At the end of the fifth week**, the appendage buds as ears and arm buds are located adjacent to the heart.
- The hind limb buds appears little behind the forelimbs.
- The embryonic body undergoes cranial, cervical, dorsal and lumbosacral flexures to accommodate itself in the pregnant horn.



Stage of development	Beef	Lamb pig	Chicken	
Forelimb bud	24	20	16-17	2.2
Hind limb bud	26	21	17-18	2.2
Foetus	45	21	20	5

- 1- The blastocyst hatching i.e. to enlarge to be free from the zona pellucida in the uterus.
- 2- The trophoblasts proliferate in all directions with higher proliferation rate at the area covering the embryonic cell mass adhering to the uterine mucous membrane.
- 3- The trophoblasts begin to erode the hormonally prepared uterine mucosa by the rapidly proliferating cell layers:
  - a) In some animals through an enzymatic like mechanism.
  - b) In other animals by an amoeboid and engulfing mechanism of the uterine mucosa.
- 4- The establishment of the attachment between the chorionic villi of the fetal membranes and the endometrium of the maternal side.
- 5) The whole blastodermic vesicle becomes finally located in the uterine submucosa, where the complete connection between the fetal and the maternal circulations is gradually established.

BL: Blastocyst, ZP: Zona pellucida, LE: Luminal epithelium of the endometrium, CT: Cytotrophoblast, LEF: Leukemia embryonic factor, P: Pinopode, GE: Glomerular epithelium, egg130: soluble egg130, ST: Spinytrophoblast, IL-1: Interleukin-1

The most important processes proceeding during this stage are:

**Organogenesis**

The most important processes proceeding during this stage are:

**Formation of fetal membranes**

1. What are extra-embryonic membranes?  
 Extra-embryonic membranes are membranous structures that appear in parallel with the embryo and play important roles in the embryonic development. They form from the embryo but do not become part of the individual organism after its birth

The embryos of reptiles, birds, and mammals produce 4 extra-embryonic membranes:

1. Chorion.
2. Amnion
3. Allantois
4. Yolk sac.

The most important processes proceeding during this stage are:

**implantation**

The **implantation** is the process by which the permanent connection is established between the fetal and the maternal circulations during the whole intrauterine life.

**1) The amnion:**  
**Def. It is the sac directly enveloping the growing embryo.**  
 It is formed histologically from the following layers: ectoderm, somatic mesoderm, then somatic mesoderm and finally ectoderm. The amniotic cavity has the functions of preventing dehydration of the embryo and of protecting it against mechanical shocks. The amnion begins to be formed in the 13<sup>th</sup> post-coital day in cow.

**2) The chorion:**  
**Def.** It is the fetal membrane that covers the amnion, the yolk sac and the allantois.  
 It is formed by a layer of allantois fused with a layer of somatopleura. The allantoic membrane and vessels over the inner face of the serosa, establishing in this way the main connection between the maternal and fetal circulations.

The diagram shows a cross-section of an embryo within the chorion. Labels include: Amniotic cavity, Amnion, Villi, Umbilicus, Yolk sac, Extraembryonic coelom, Allantois, and Allantoic mesoderm. The Chorion is highlighted with a green circle.

1 umbilicus  
 2 amnion.  
 3 allantois  
 4 Yolk sac

The photograph shows a dissected embryo with numbered labels: 1 (umbilicus), 2 (amnion), 3 (allantois), 4 (yolk sac), and 6 (chorion).

**3) The allantois:**  
 The allantois is the extraembryonic membrane whose function is to store the excreted matter of the embryo.  
**What is the chorioallantois membrane present in the embryonic development of reptiles and birds? How does this membrane participate in the energetic metabolism of the embryo?**  
 The chorioallantois membrane is formed by juxtaposition of some regions of the chorion and the allantois. Since it is porous, the chorioallantois membrane allows the passage of gases between the embryo and the exterior thus making aerobic cellular respiration possible.

The diagram shows the chorioallantois membrane with labels: Coelom, Amniotic folds, Chorion, Yolk sac, Trophoblast (ectoderm), Allantois, and Allantochoerion. The Allantois and Allantochoerion are highlighted with green circles.

**3-Fetal stage** Crown to Rump Length

This stage begins w... continuous till partu... During this period and physiologically...

embryonic stage and become anatomically

**In cows**

- This stage begins at the 45<sup>th</sup> post-coital
- rate of growth of 1 cm/week till the 11<sup>th</sup> week, then 2 cm/week.
- The crown vertebral rump length (CVRL) of the fetus in cow = month of pregnancy × (month of pregnancy + 2).
- The age of the fetus is determined from CVRL (in cm).
- age in days = 60 + 2.5 × CVRL (cm).
- the average weights of the fetus at full term are as follows: cow calf, 25-45 kg; buffalo calf 25-35 kg.

**In mares**

- stage begins at the 50<sup>th</sup> day post-coital.
- Rate of growth 1cm/week for the first 3 weeks.
- The crown vertebral rump length (CVRL) of the fetus in foal = age of pregnancy × (age of pregnancy + 1).
- the average weights of the warm blooded foals at full term is 30-45kg.

**4) The yolk sac:**  
**Def.** is an extra-embryonic sac formed from the covering of the vitellus by some cells originated from the primitive gut.  
 The yolk sac stores vitellus, the main nourishment source of non-placental embryos or before implantation.

The diagram shows a cross-section of an embryo with labels: Embryo, Gut, Amnion, Amniotic cavity, Chorion, Yolk, Yolk sac, Allantois, and Allantoic membrane. The Yolk sac is highlighted with a red dashed circle.

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	Calf	Foal	Lamb	Carnivores
Weight	25-40 kg depend on age, breed or 6-8 (1/12) of the mother before calving	30-60 kg depends on age, breed or 1/15 of the body of the mother before foaling.	1.5-3.5kg according to breed and number of feti given.	The weight of the fetuses varied greatly in the different species of dogs and cat.
Length CVRL	70-75 cm according to the age and breed.	100-150 cm according to age and breed.	40-50 cm	The length of the fetuses varied greatly in the different species of dogs and cat.
Hairing	2 cm all over the body 4 cm around umbilicus.	No hairs are found around the navil and the inner side of the thigh. Long hairs on the mane and tail.	Thick hairing in the area of the navil and lesser all over the body.	mature born is covered with thick hair. The eye-lids are closed with an epithelial covering for 8-10 days during which the animal is blind.
Teeth	4 milky teeth in the lower jaw, regular and well developed.	4 milky regular and just erupting from the gum in both jaw.	The tips of cutting teeth are seen penetrating the gum.	No teeth are seen erupting from the gum.