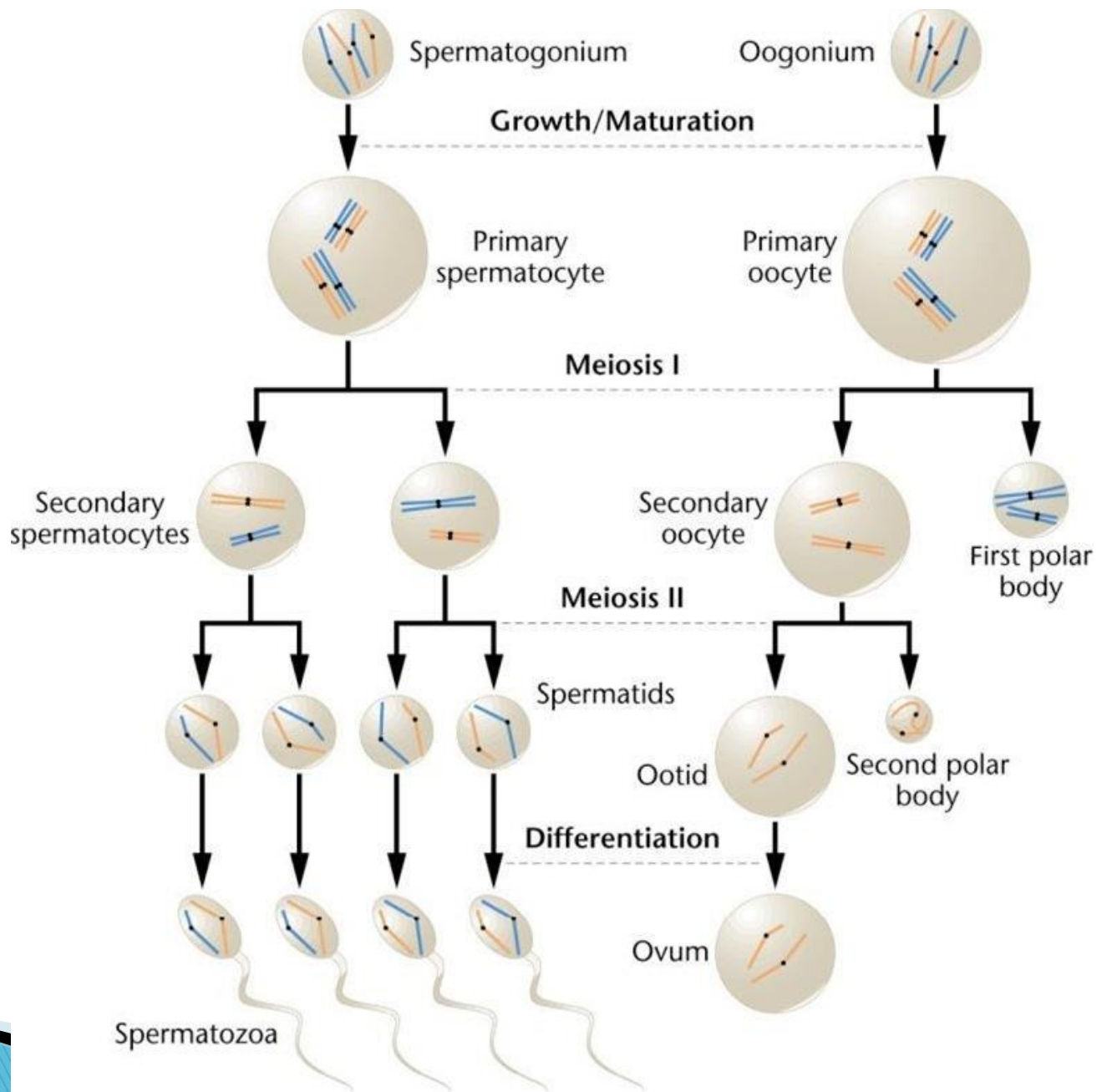


Oogenesis and Spermatogenesis





Reproductive Functions of the Female

Estrous cycle – Following puberty, time from one heat period (or menstrual cycle) to the next.

Oogenesis – Production of the female sex cell (ova), through the process of meiosis, results in ova containing half the chromosome number of the body cells.

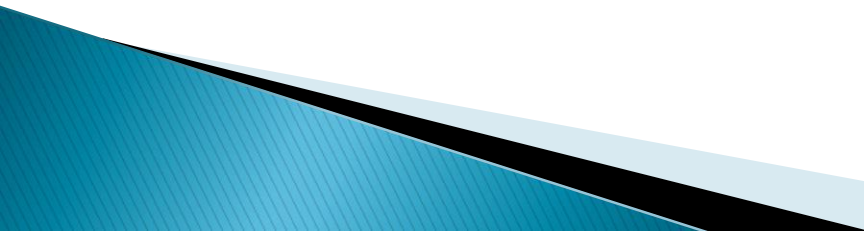
Length of estrous cycle by species:

Cow	19 – 21 days
Ewe	16 – 17 days
Sow	19 – 21 days
Mare	21 – 24 days
Woman	28 days
Hen	none

Reproductive Functions (Female)

Steps in the female reproductive process:

1. Ovulation

- Produce gamete (ova or ovum).
 - Release of egg(s).
 - Infundibulum pushes the ovum into the fallopian tube.
 - Each ovum surrounded by a fluid-filled (blister-like) follicle, which enlarges on the surface of the ovary.
 - At the same time, estrogens are produced in the walls of the developing follicles.
 - Ovulation occurs at the end of heat (shortly after the end of heat in the cow).
- 

Ovulation Rates

Ovulation Rates by Species

Cow–	1 egg per estrus
Ewe–	1 to 3+ eggs per estrus
Sow–	10 to 20 eggs per estrus
Mare–	1 egg per estrus
Hen–	Approx. 28 eggs per month

Reproductive Functions (Female)

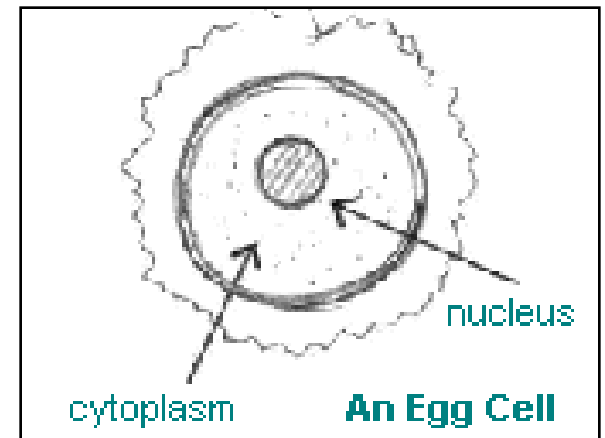
2. Estrus (heat)

- Period of time when a female will accept a male in copulation
- The female must stand (**standing heat**) to be mounted before the reproductive process can begin

Reproductive Functions (Female)

Duration of Heat by species:

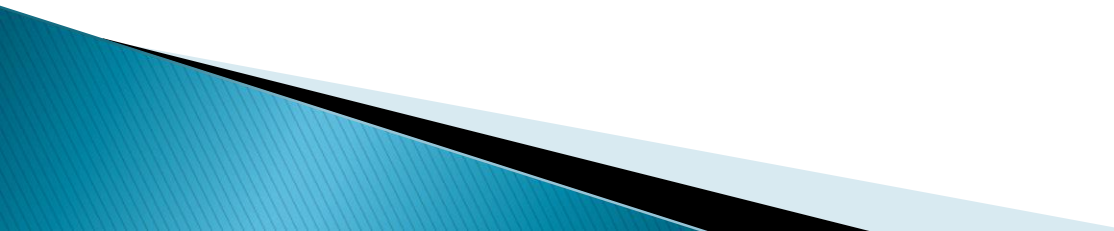
Cow	12 – 18 hours
Ewe	24 – 36 hours
Sow	48 – 72 hours
Mare	90 – 170 hours
Hens & Women	none



Reproductive Functions (Female)

- ▶ Upon ovulation, cells in the walls of each ruptured follicle multiply to form a corpus luteum.
- ▶ Pregnancy: CL is retained, produces progesterone – maintains pregnancy.
- ▶ No pregnancy: CL is regressed by prostaglandin. Within a couple days, the next heat and subsequent ovulations occur.
 - CL regresses to a small scar on the surface of the ovary: Corpus albicans.

Polyestrous

- ▶ Females of species that have no specific breeding season, also called continuous breeders.
 - ▶ Seasonally polyestrous: ewe – breed only during certain seasons, but has several estrous periods during the breeding season.
 - ▶ Ewe: decreasing daylight of fall brings seasonally polyestrous ewes into heat. (short day breeders)
 - ▶ Mares: Most nonpregnant and nonlactating become sexually active as daylight increases in the spring. (long day breeders)
- 

Reproductive Functions (Female)

3. Gestation

- Conception to parturition
- Develop embryo in uterus

4. Parturition

- Expel fully developed young at birth

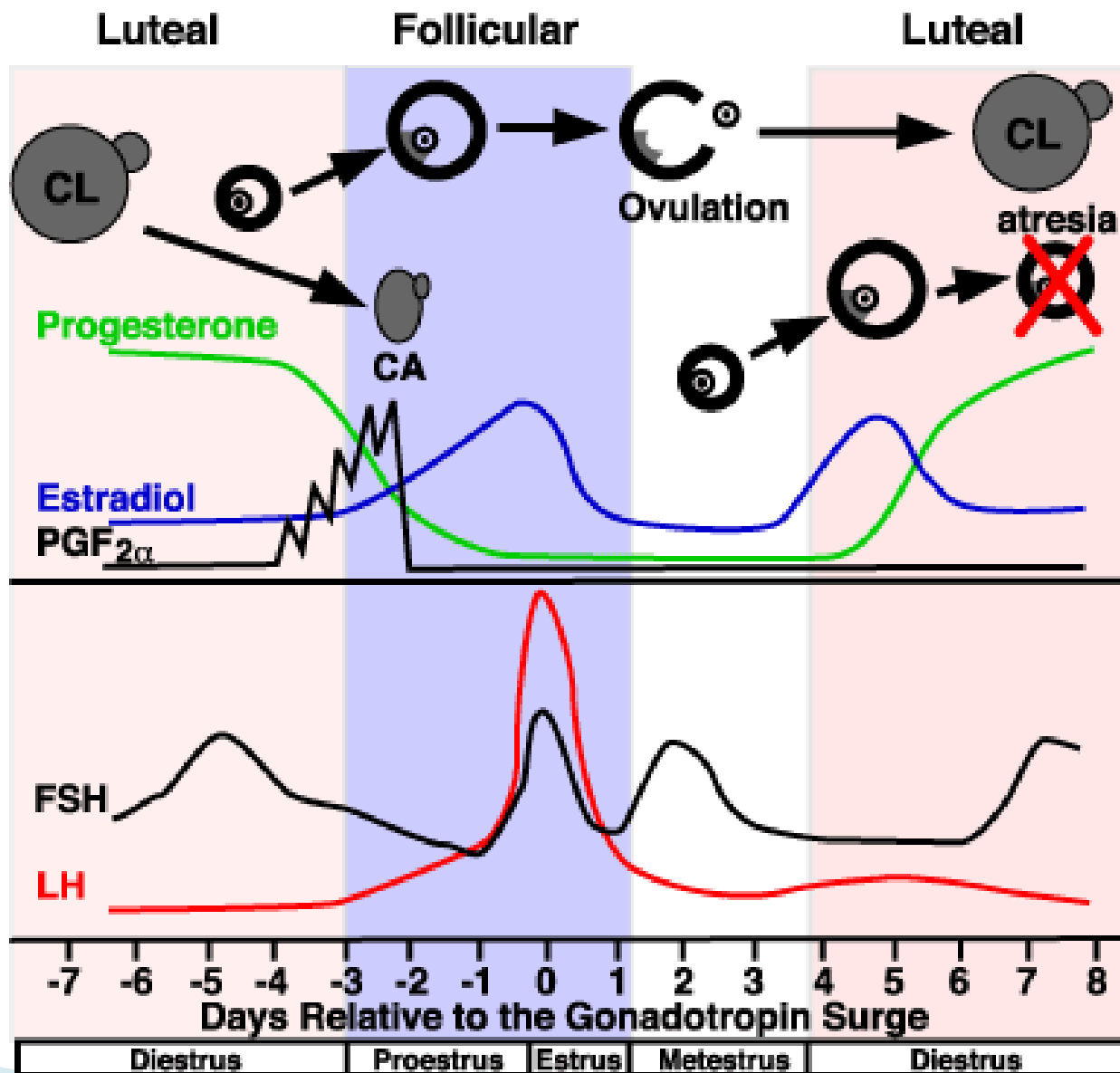
5. Lactation

- Milk production

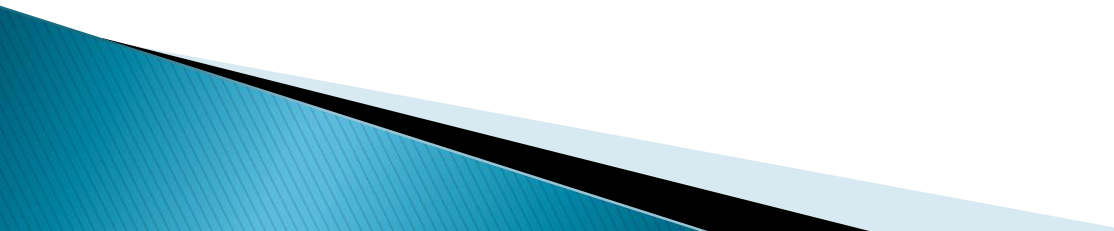


The Estrous Cycle





Proestrus

- ▶ Period between regression of the CL and standing heat.
 - ▶ When follicular development is occurring.
 - ▶ Estrogen production is increasing.
 - ▶ About the 18th – 20th days of the bovine cycle.
- 

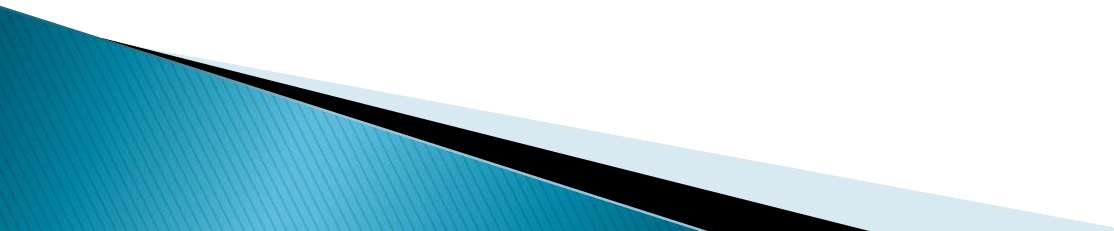
Estrus

- ▶ Period when the female is sexually receptive.
- ▶ Often referred to as “standing heat”.
- ▶ Estrogen rises until ovulation.
- ▶ Depending on species, length of estrus ranges from 12 hours to several days.
- ▶ Estrogen levels bring about a surge of LH and FSH.
 - Increased LH triggering ovulation toward the end or shortly after estrus.
 - Day 1 in the bovine cycle.

Metestrus

- ▶ Begins with ovulation.
- ▶ Corpus hemorrhagicum forms, then changes into corpus luteum.
- ▶ Days 2–5 in the bovine cycle.

Diestrus

- ▶ Phase when the CL is highly active in its production of progesterone.
 - ▶ If pregnancy occurs, the CL is maintained and further estrus is inhibited.
 - ▶ If conception does not occur, release of prostaglandin from the uterine walls causes regression of the CL.
 - ▶ Proestrus begins again.
 - ▶ Days 5–18 in the bovine cycle.
- 

Female Reproductive Hormones

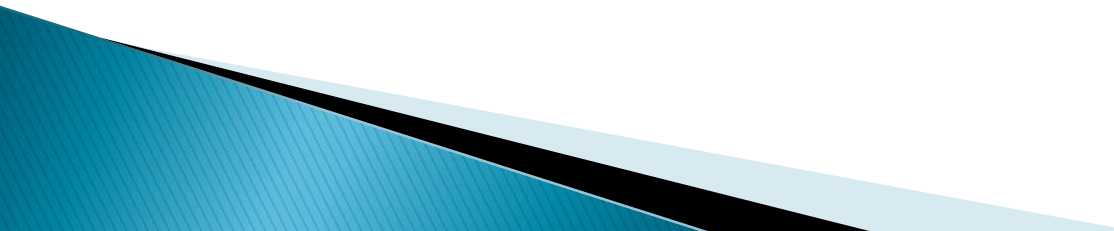


Female Reproductive Hormones

- ▶ Gonadotropin-releasing hormone (GnRH): produced in hypothalamus (brain).
 - Controls release of two gonadotropic hormones from the pituitary gland, FSH and LH.
 - FSH: follicle stimulating hormone. Stimulates follicle development and estrogen production.
 - LH: luteinizing hormone. Triggers ovulation and is necessary for development and maintenance of the CL.

Female Reproductive Hormones

▶ Estrogen

- Produced by ovarian follicles.
 - Causes sexual excitability.
 - Increases fluid production and muscular contractions of the reproductive tract.
 - Triggers release of LH from the Pituitary Gland.
- 

Female Reproductive Hormones

▶ Oxytocin

- Secreted from the posterior pituitary.
- Acts on receptors that:
 - Create orgasms
 - Cause release of milk during lactation (milk letdown)
 - Causes relaxation of cervix during parturition

Female Reproductive Hormones

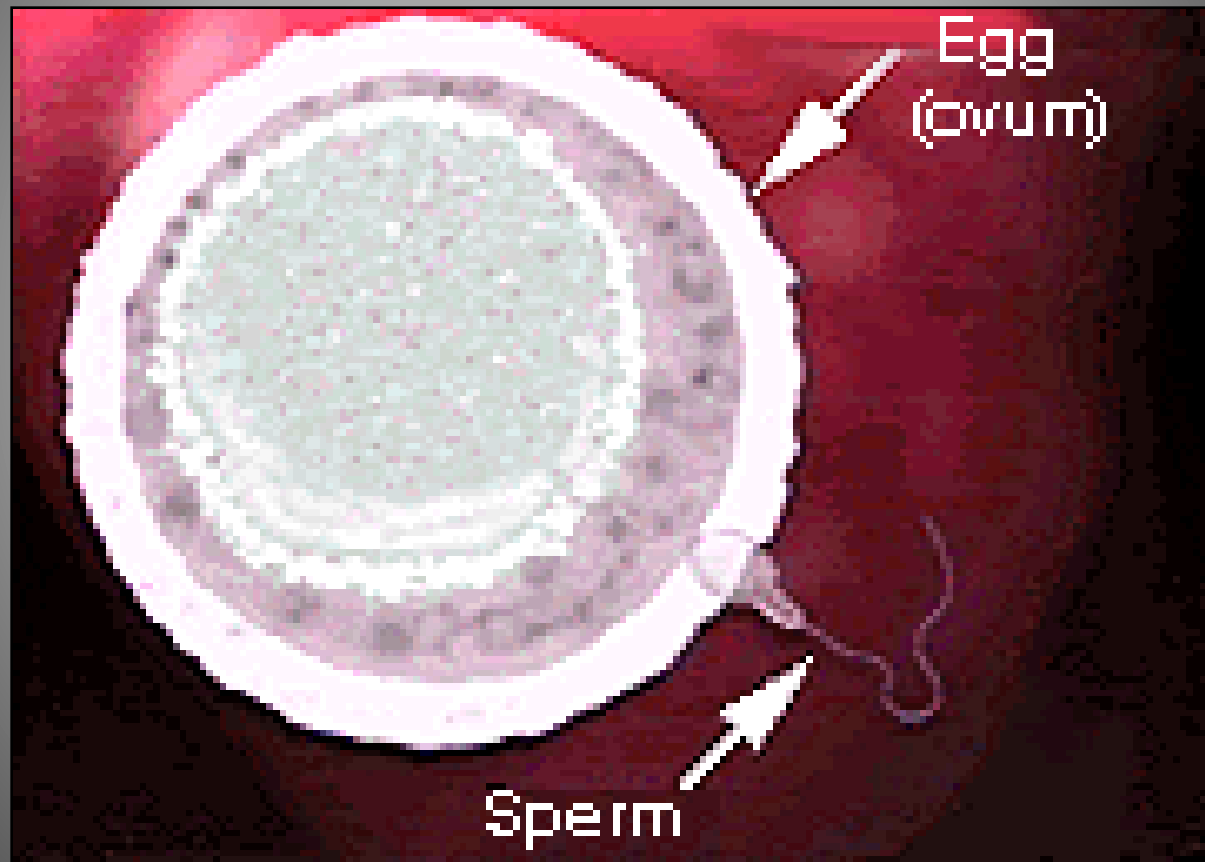
▶ Progesterone

- Produced by the functional Corpus luteum.
- Prevents estrus during pregnancy (maintains pregnancy).
- Causes increased vascularity of the uterine horn and body to enhance survival of the embryo during implantation.
- Increased development of the alveolar structures in the mammary gland (produce milk).

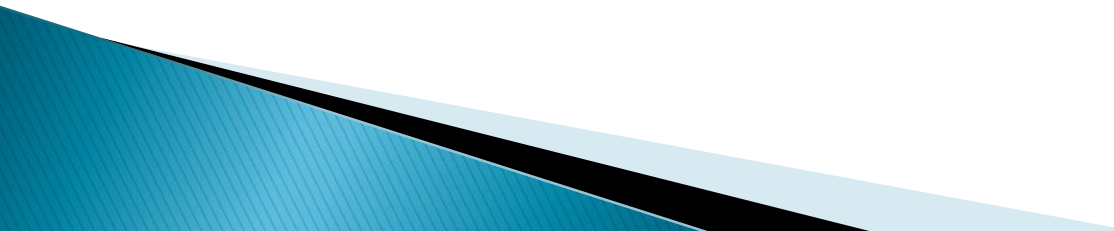
Female Reproductive Hormones

- ▶ Prostaglandin ($\text{PGF}_2\alpha$)
 - Hormone produced in the uterine wall.
 - Causes regression of the CL when pregnancy does not occur.

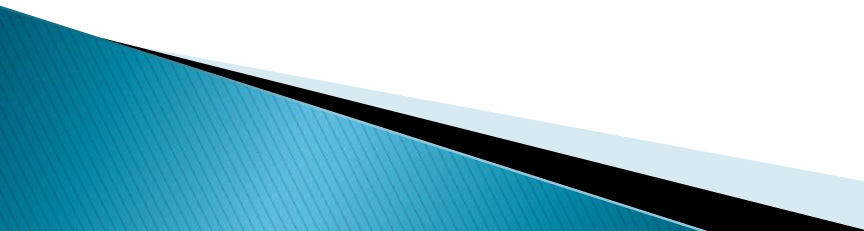
Pregnancy and Parturition



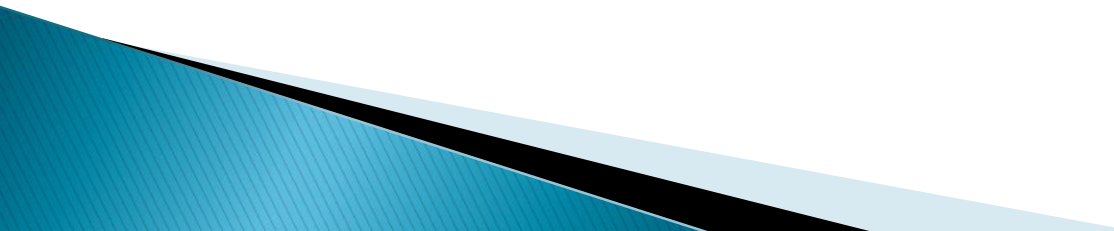
Fertilization

- ▶ When the sperm from a male reaches the egg from a female
 - ▶ Two cells join to form a complete cell
 - ▶ Pairs of chromosomes are formed again
 - ▶ Many different combinations of traits are formed
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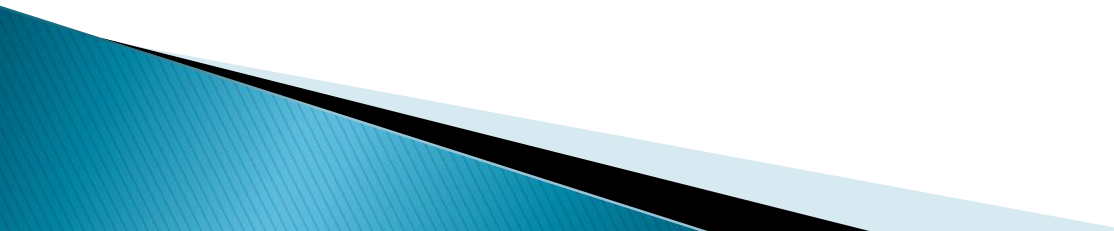
Pregnancy

- ▶ Gestation length varies considerably among animals within a species.
 - ▶ Influenced by: Age, breed, number of fetal developments, environment.
 - ▶ Exact, detailed process of sperm and ovum combination is not completely known.
 - ▶ Some species: Sperm head attaches to the ovum.
 - ▶ Sperm tail may help sperm head penetrate the membranes around the ovum.
- 

Pregnancy

- ▶ Sperm enzymes play a role in helping the head and tail penetrate the ovum and become engulfed in the ovum cytoplasm.
 - ▶ Membranes surrounding the ovum change structure to prevent entrance of other sperm.
 - ▶ Fertilized ovum (zygote): Sperm and ovum nucleus come into close contact – complete chromosome pairs become evident.
 - First cell division – growth of the zygote.
 - Division of a single zygote results in genetically identical twins.
- 

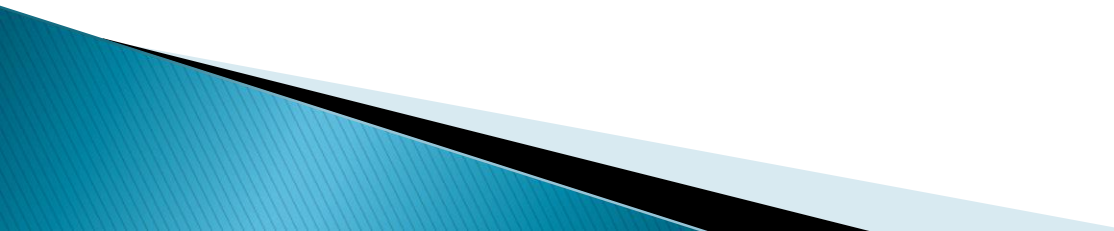
Pregnancy

- ▶ Zygote travels through oviduct to uterine horn and attaches to uterine wall.
 - ▶ Now 16 cells (morula stage).
 - ▶ Implantation: Zygote's enzymes digest a small depression in the endometrial lining.
 - ▶ Implants and continues to develop.
 - ▶ After implantation: capillaries develop at the site to nourish the developing embryo.
- 

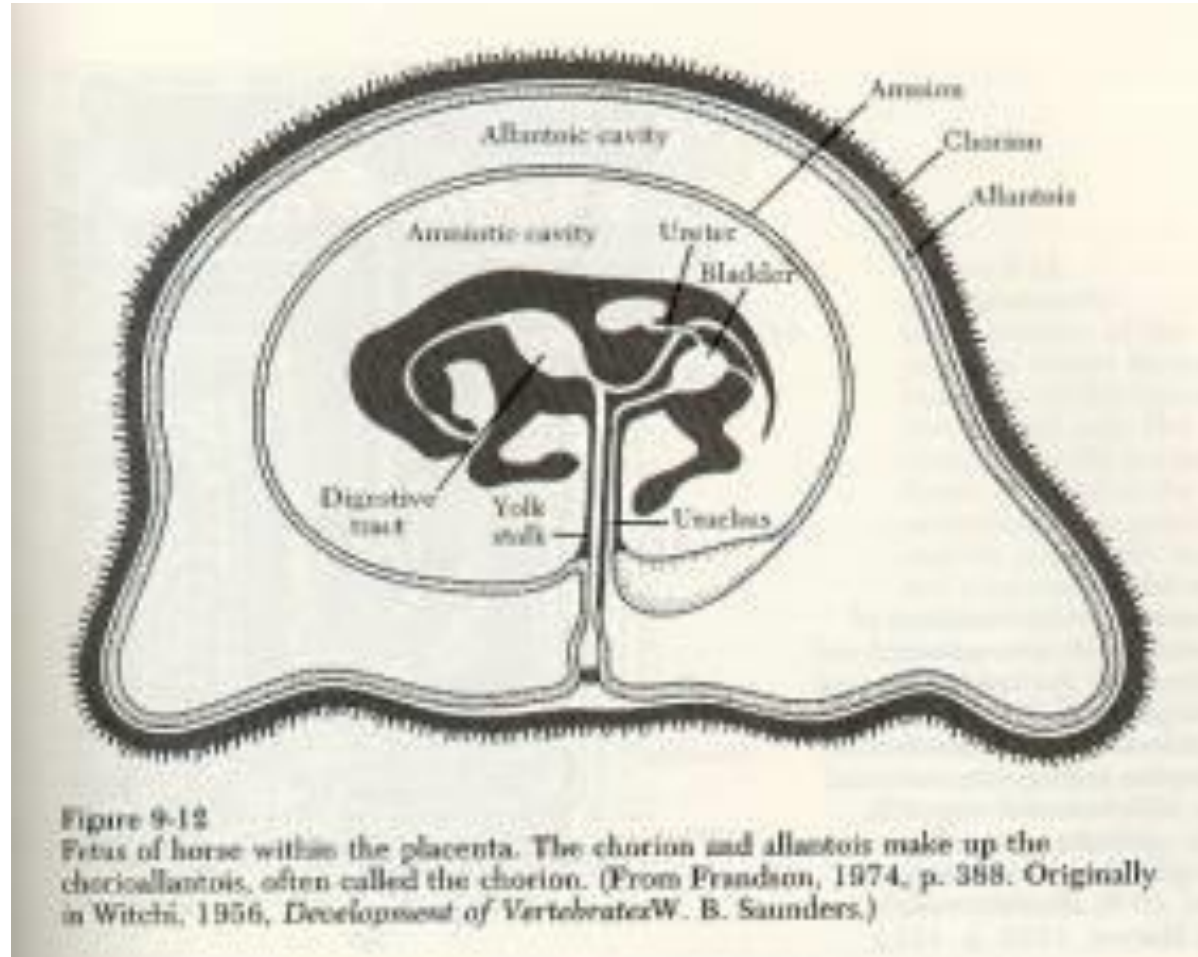
Pregnancy

- ▶ Placentation: Development of extra-embryonic, vascular (blood carrying) membranes. Provide movement of oxygen and nutrients from the endometrium of the dam to the fetus and fetal metabolic waste to the dam's circulatory system.

Structures of the Placenta

- ▶ Chorion: Outermost membrane. In contact with the endometrial lining of the uterus of the dam.
 - ▶ Allantois: Second membrane. Lines the inside of the chorion and joins the amnion to form the fluid-filled allantoic cavity. Membranes of the allantois also lead to the fetal bladder to provide waste removal.
 - ▶ Amnion: Innermost membrane, surrounds the fetus. Forms the second fluid-filled sac. Fluid cushions the fetus from shock.
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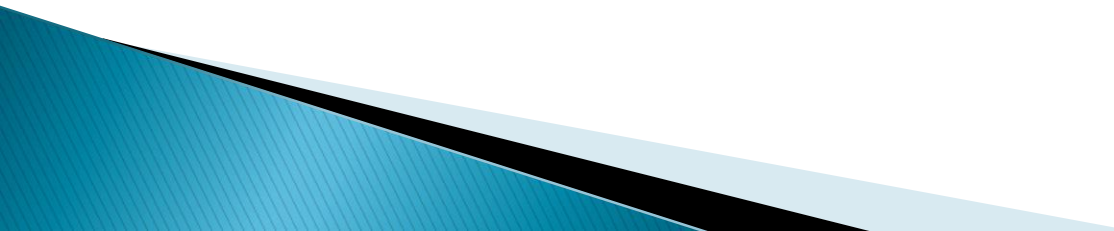
Structure of the Placenta



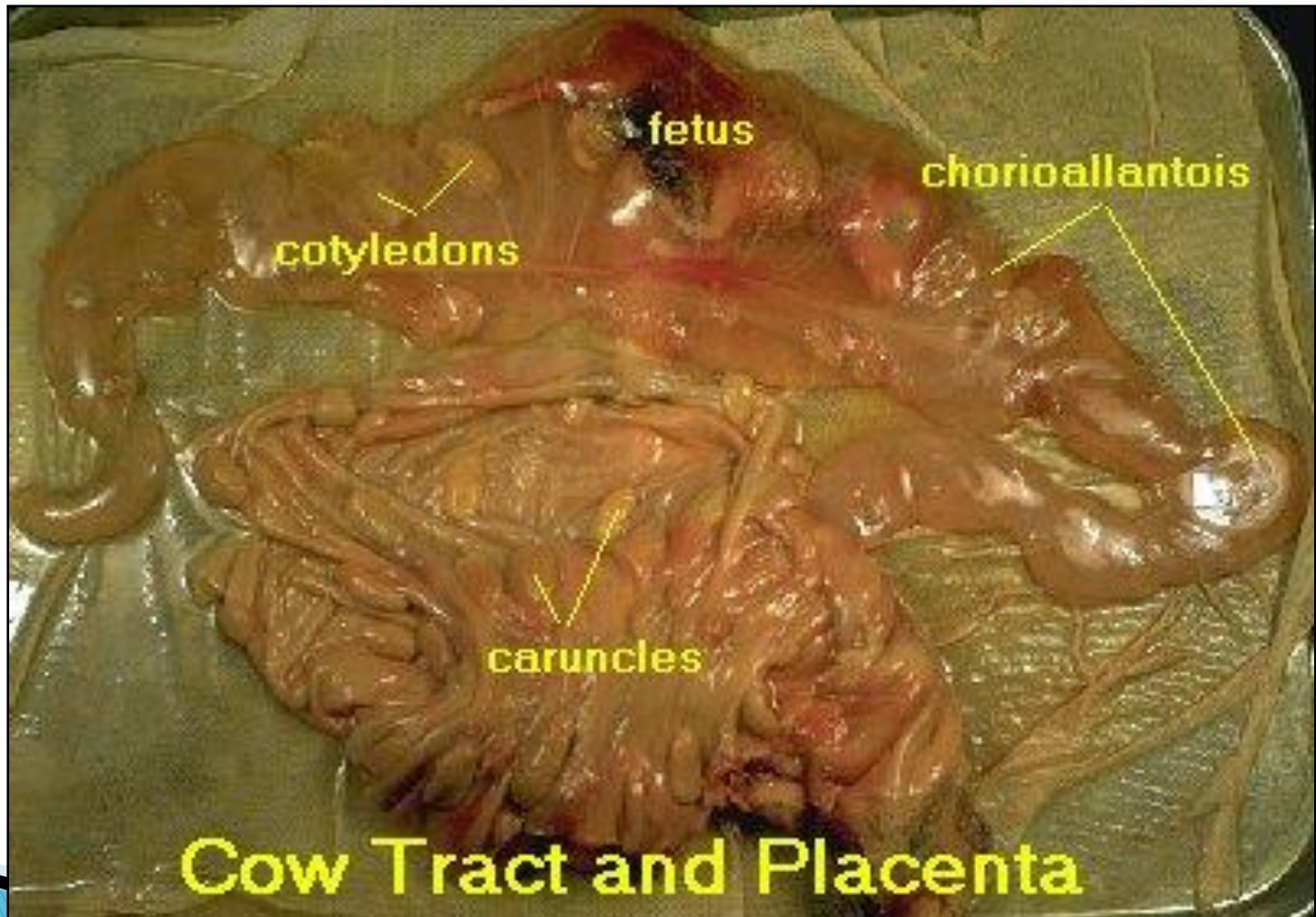
Structures of the Placenta

- ▶ Umbilical cord: Arteries that carry oxygen and nutrients from the dam to the fetal placenta and the vein that returns metabolic wastes from the fecal bladder to the dam.
- ▶ No direct exchange of blood between the maternal and fetal system.
 - Nutrients, oxygen, and metabolic waste pass thru placental membranes.
 - Membranes prevent passage of antibodies from dam to fetus = NO immunity. Why it's so important for a newborn to get adequate colostrum ASAP after birth.

Placenta – types

- ▶ Ruminants: cotyledons on the chorion surface attach to the caruncles of the endometrium to form very secure connections (called placentomes).
 - ▶ Mare: Attachment more diffuse – cover greater area of the chorion, but not as strongly attached.
 - ▶ Sow: Attachments even more diffuse.
 - ▶ Retained placenta (more of a problem in cattle), is likely due to the type of placental attachment.
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Gravid (Pregnant) Reproductive Tract



Gestation

Gestation and Lactation Periods:

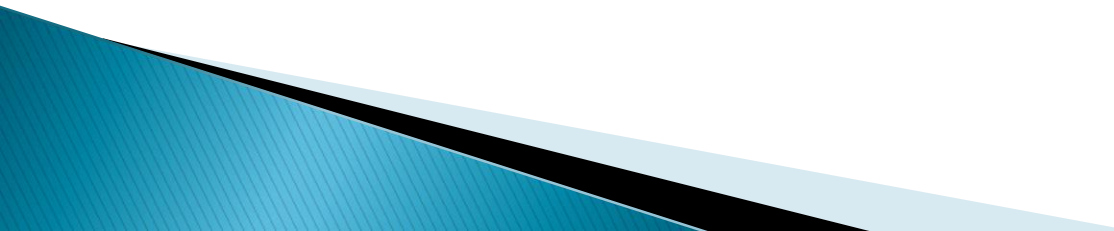
<u>Species</u>	<u>Gestation Period</u>	<u>Lactation (Milking)</u>
Cow	285 days	Beef 205 days Dairy 305 days
Ewe & Doe	148 days	45 – 90 days
Sow	114 days	18 – 42 days
Mare	336 days	90 – 150 days
Woman	270 days	weeks to years

Lactation depends to a degree on regular nursing. Mothers will dry off if milk isn't regularly removed from the mammary glands.

Reproductive Terminology – Parturition

<i><u>Species</u></i>	<i><u>Act</u></i>	<i><u>Offspring</u></i>
Cows	calving	calf
Ewes	lambing	lamb
Sows	farrowing	pig
Hens	hatching	chick
Mares	foaling	foal
Goats	kidding	kid
Dogs	whelping	pup or whelp
Cats	queening	kitten

Parturition

- ▶ Last few days of gestation: Increased estrogen produced by placenta stimulates prostaglandin from the uterus – regresses CL, lower progesterone.
 - ▶ CL produces relaxin – relaxes pelvic muscles and ligaments in the pelvis and fetus is moved into birth position – ‘Diver’.
 - ▶ Prolactin – stimulates milk synthesis.
 - ▶ Oxytocin – Steadily increasing uterine contractions until delivery.
- 

Parturition

- ▶ 3 Stages:
 - ▶ 1. Contractions (posterior direction), entry of the fetus into the dilated cervix.
 - ▶ 2. Rupture of the allantochorionic sac through the cervix (her water broke) and complete expulsion of the fetus by more intense uterine and abdominal contractions.
 - ▶ 3. Expulsion of the placenta (afterbirth).
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