



ESTROUS CYCLE IN CANINE AND FELINE

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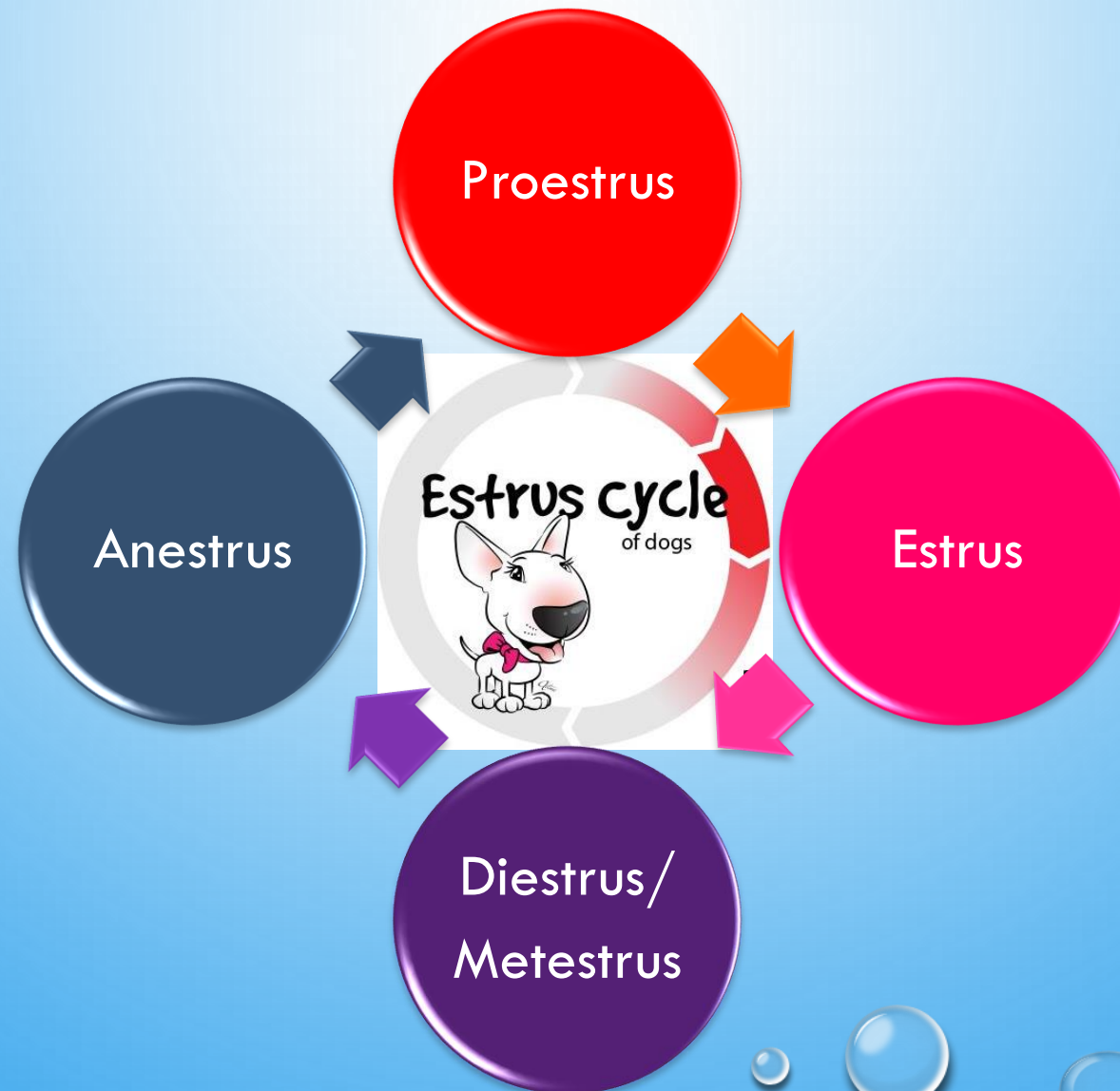
DEPARTMENT OF VETERINARY GYNAECOLOGY AND OBSTETRICS

BIHAR VETERINARY COLLEGE, BASU, PATNA

- Differs from other polyestrous species.
- **Mono-estrus** - All bitches have a prolonged period of anestrus or sexual quiescence between successive estruses irrespective of whether they have been pregnant or not.
- No luteolytic mechanism.
- **Anestrus is 'obligate'** enabling time for the endometrium to repair and lasts a minimum of 7 weeks, but averages 18 to 20 weeks.

- Towards the end of anestrus, GnRH pulse frequency and amplitude increases; consequently, FSH concentrations increase in the latter stages of anestrus.
- The average interval between successive estrous periods is 7 months, but it is variable (typically 6–10 months).

FOUR PHASES



PROESTRUS

- The bitch has a true proestrus characterised by the presence of vulvar oedema, swelling and a sanguineous discharge.
- Some fastidious bitches show no evidence of discharge, as they are continually cleaning the perineum.
- The bitch is attractive to males but will not accept the male.



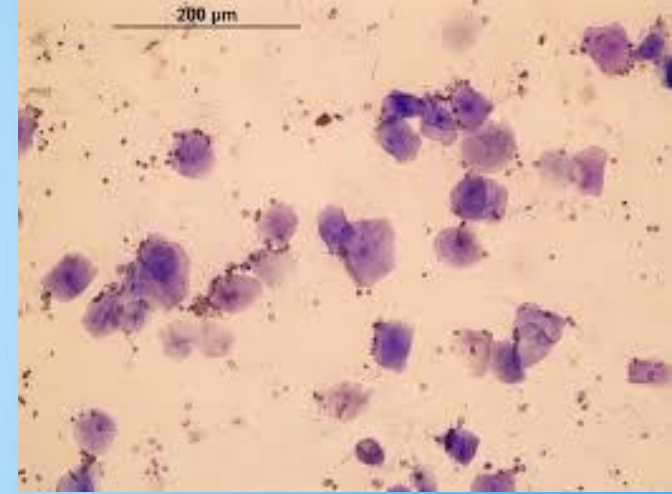
↑
Vulvar swelling

Proestral bleeding
↓



ESTRUS

- The bitch will accept the male and adopts the breeding stance.
- Vulva becomes less edematous, and the vulvar discharge becomes clearer, less sanguineous and less copious.
- Duration – 9 days (average)
- Ovulation usually occurs 1 to 2 days after the onset of estrus, although, using laparoscopy, it has been observed that some follicles continue to ovulate up to 14 days later.



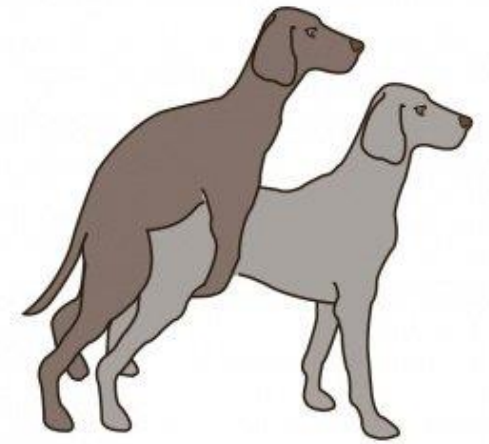
SIGNS OF ESTRUS

- Progressive labial swelling during proestrus.
- Bleeding continues from early proestrus till early estrus.
- A day or so before the end of proestrus, her attitude changes, and she shows **signs of courtship towards the male.**
- With onset of estrus, becomes **receptive to the male** and allows mounting and copulation.

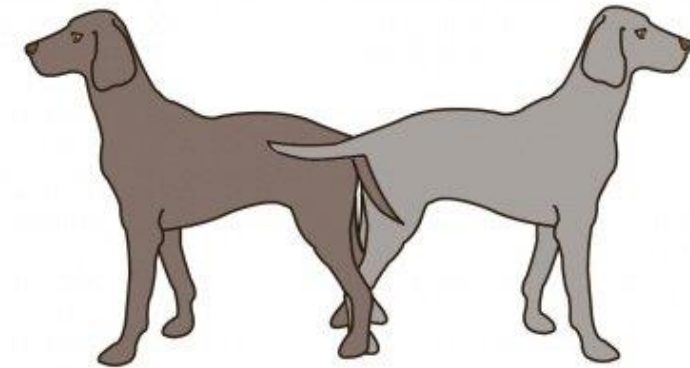
Copulatory (coital) tie



- She stands in the mating position with her tail slightly raised or held to one side, and remains still while the male mounts and copulates.
- After the first 2 days of estrus, sexual desire gradually recedes but, with the continued persuasion of the male, she will accept coitus until the end of the period.
- Vulvar swelling and tumefaction are greatest at the onset of the stage of acceptance.



Initial phase of coitus



"Tied" phase of coitus

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DIESTRUS/ METESTRUS

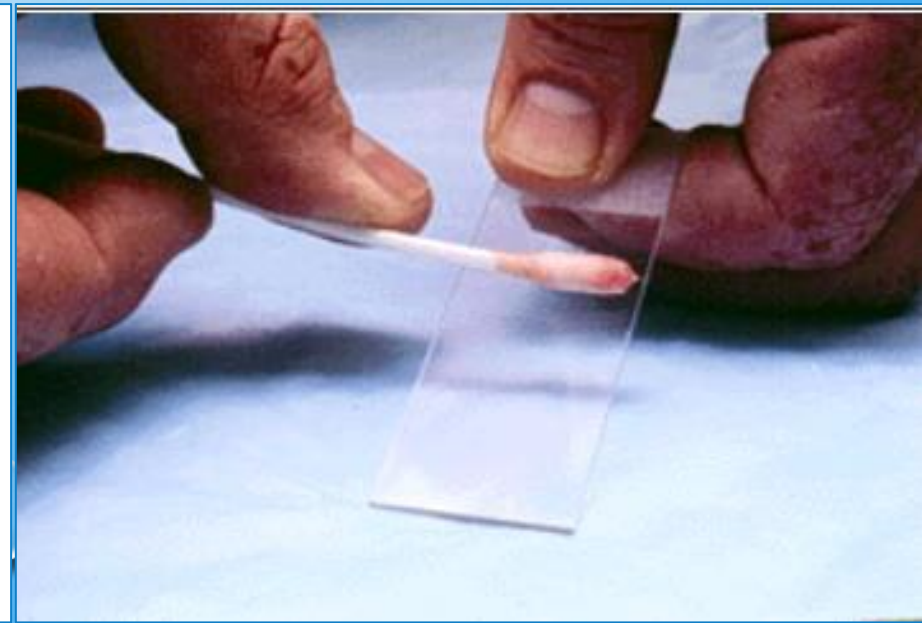
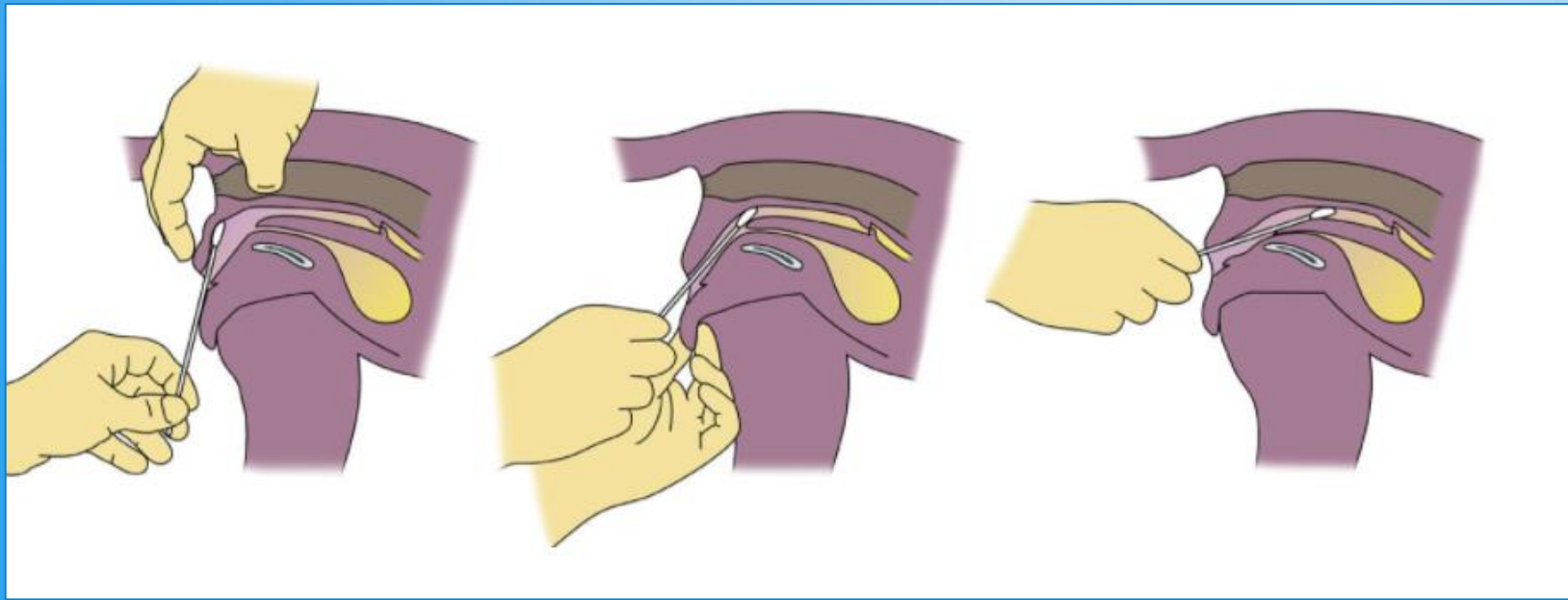
- Starts when the bitch ceases to accept the dog.
- Some consider that it ends when the CLs have regressed at 70 to 80 days.
- Others measure it in relation to the time taken for repair of the endometrium, namely 130 to 140 days.

ANESTRUS

- At the end of diestrus the bitch passes into a period of anestrus without any external signs.
- The same is also true after parturition following a normal pregnancy.
- This phase lasts 2 to 10 months before the bitch returns to proestrus.

CHANGES IN THE VAGINA AND UTERUS

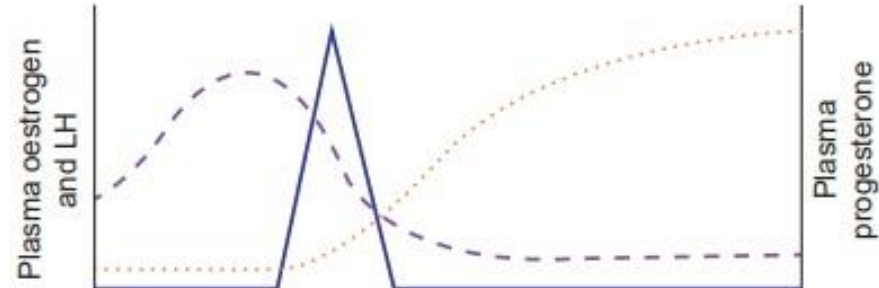
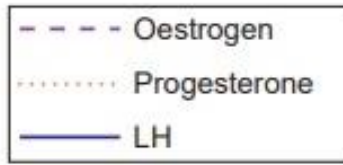
- Vaginal Smear for cytology
- Cyclical changes occur in vaginal cytology
- Leishman's stain / Giemsa stain



Vaginal epithelium

- During anestrus is of the low, columnar, cuboidal type and comprises two or three layers only.
- During proestrus the epithelial cells change to the high, squamous, stratified type and persist in this form until the later stages of estrus.
- The stratum corneum and the layers immediately beneath it are lost by desquamation during the proestrus and estrus periods, leaving a low, squamous structure that becomes converted to columnar epithelium in 1 to 3 weeks after the end of estrus.

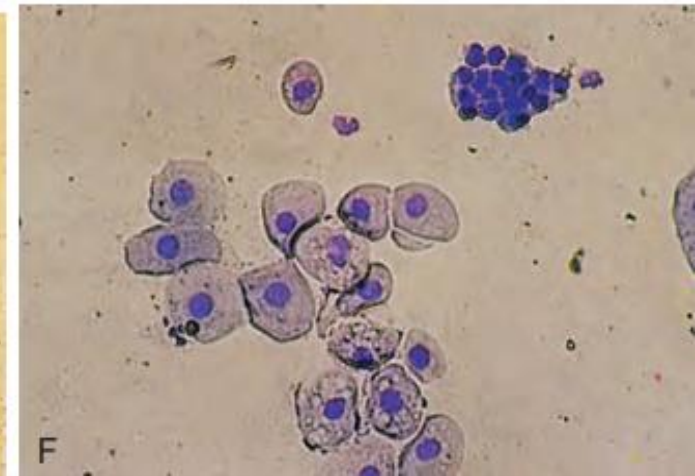
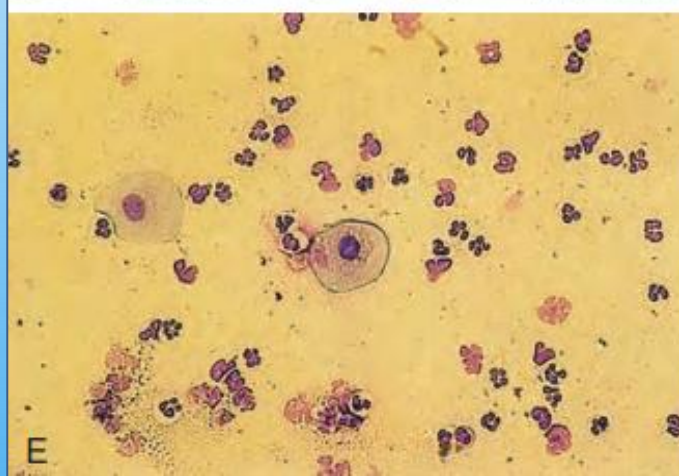
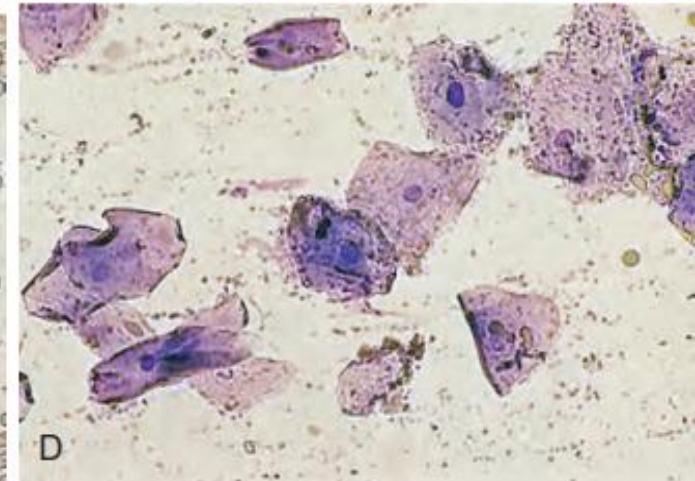
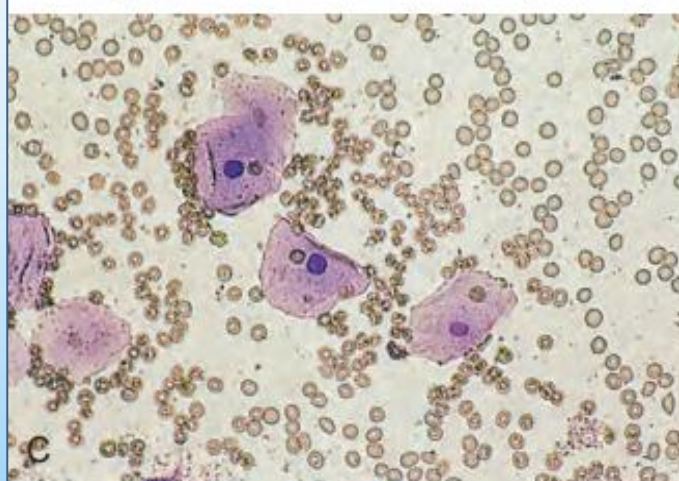
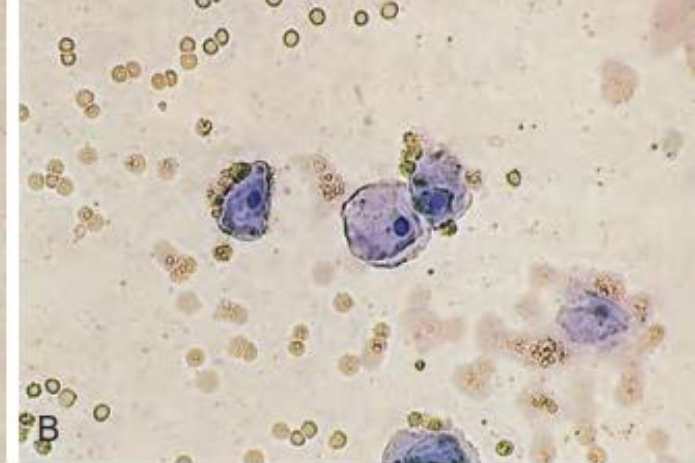
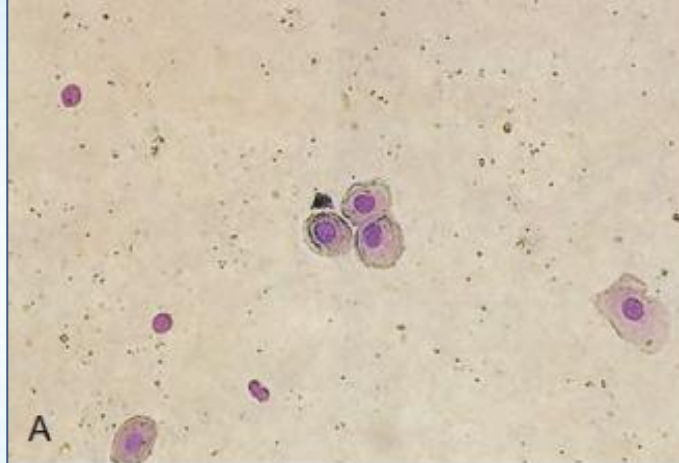
- During diestrus (and pregnancy) the epithelium is of a higher columnar type than during anestrus.
- During proestrus, estrus and early diestrus, the epithelium and lamina propria are infiltrated with large numbers of neutrophils, which eventually escape into the vaginal lumen.



Cell type		Prooestrus		Oestrus		Early metoestrus	Anoestrus	Vaginitis pyometra
		Early	Late	Early	Late			
Parabasal		+++	+				++	±
Small intermediate		+++	++	-	-	+	+	±
Large intermediate		±	++	+++	+++	-	-	±
Anuclear keratinized		-	++	++++	+++	±	-	-
Red blood		+	+++	++	-	-	±	±
Neutrophils		+	-	-	+	+++	+	++++

Changes in the types of cell and their relative numbers in vaginal smears from the bitch during the different stages of the oestrous cycle, and changes in oestrogen, progesterone and luteinising hormone levels in the peripheral plasma.

- A. Anestrus – parabasal and small intermediate epithelial cells
- B. Proestrus – small and large intermediate epithelial cells; RBCs
- C. Early estrus - large intermediate and anuclear epithelial cells; RBCs
- D. Estrus - anuclear and large intermediate epithelial cells; RBCs
- E. Diestrus - small intermediate epithelial cells and large numbers of polymorphonuclear leucocytes
- F. Late diestrus - parabasal epithelial cells and small vacuolated intermediate epithelial cells



ENDOMETRIUM

- The endometrial glands in proestrus and estrus are loosely coiled with very obvious lumina and deep epithelial lining.
- During diestrus the glands become larger, the lumina smaller, and the coiled parts in the basal layer of the endometrium more tortuous.
- As the bitch passes into anestrus, there is a reduction in the amount and degree of coiling of the glands.
- By about 120 to 130 days, the epithelium has been restored by proliferation of cells from the crypts of the endometrial glands.

CHANGES IN OVARIES

- At the commencement of proestrus, developing follicles have already attained a diameter of 4 mm.
- They progressively enlarge until, at the time of ovulation, their size varies from 7 to 11 mm.
- Because of the thickness of the follicle wall, it may be difficult to distinguish between follicles and CLs.
- Prior to ovulation, the surface of the follicle shows a slightly raised papule, pinhead-sized, and the epithelium covering it is brown.

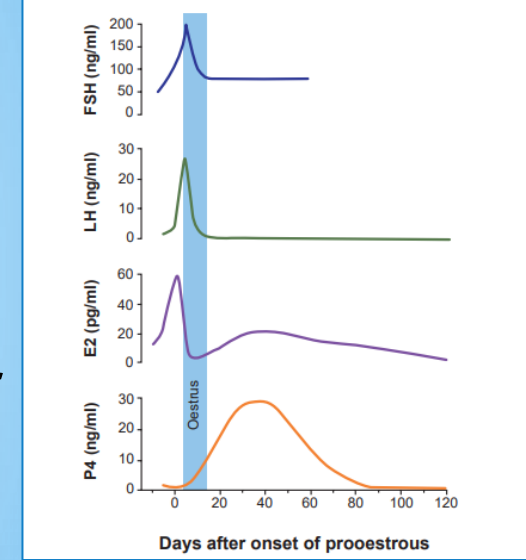
- A remarkable feature of the ovulatory follicle of the bitch is the thickness of its wall.
- This is due to hypertrophy and folding of the granulosa cells, which can be seen on section with the naked eye as evidence of preovulatory luteinisation.

- Ovulation is spontaneous, and normally occurs 48 to 60 hours after the LH surge
- Unlike other domestic species in which a secondary oocyte is ovulated, the oocyte in the bitch is ovulated at the primary stage.
- The oocyte will then mature and become a secondary oocyte and is capable of being fertilised after 96 to 108 hours.
- The secondary oocyte remains viable for 24 to 48 hours (day 5 or 6 after LH surge), but occasionally up to 144 hours (day 10) after ovulation

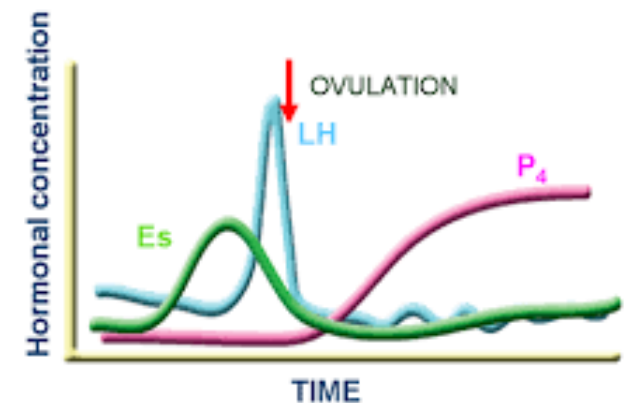
- The CL at first contains a central cavity, but becomes filled by compact luteinised cells within 10 days of ovulation, by which time the body has attained its full size (6–10 mm); CLs now comprise the greater mass of the ovary.
- As a rule, an approximately equal number of CLs are found in each ovary, although occasionally there are wide differences.

ENDOCRINOLOGY OF ESTROUS CYCLE

- The main feature that distinguishes them from other domestic species is the prolonged luteal phase.
- Progesterone levels start to rise before ovulation has occurred due to preovulatory luteinisation.
- Preovulatory rise in progesterone may provide the stimulus for the bitch to accept the male.

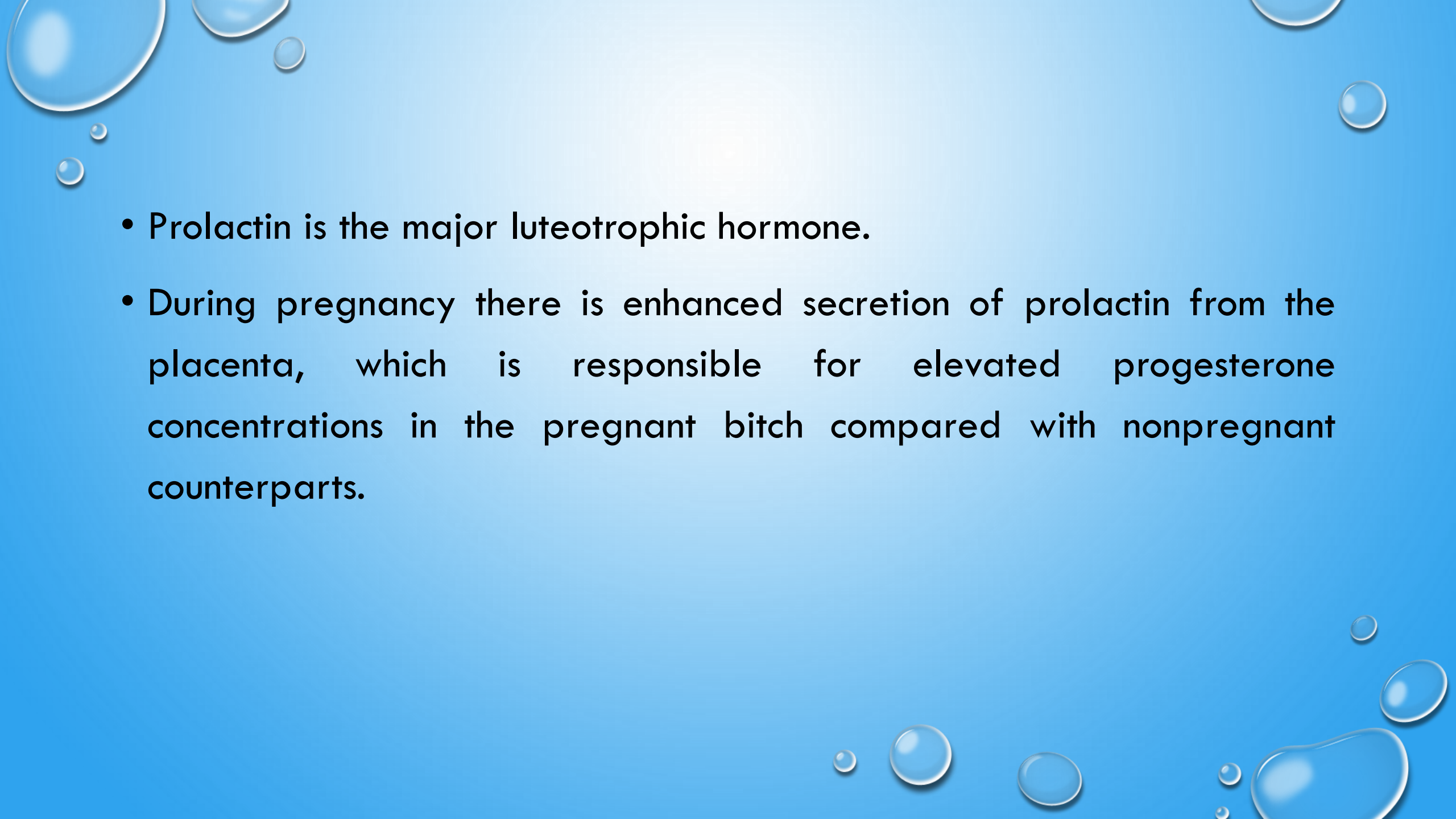


ENDOCRINE PROFILE IN THE BITCH

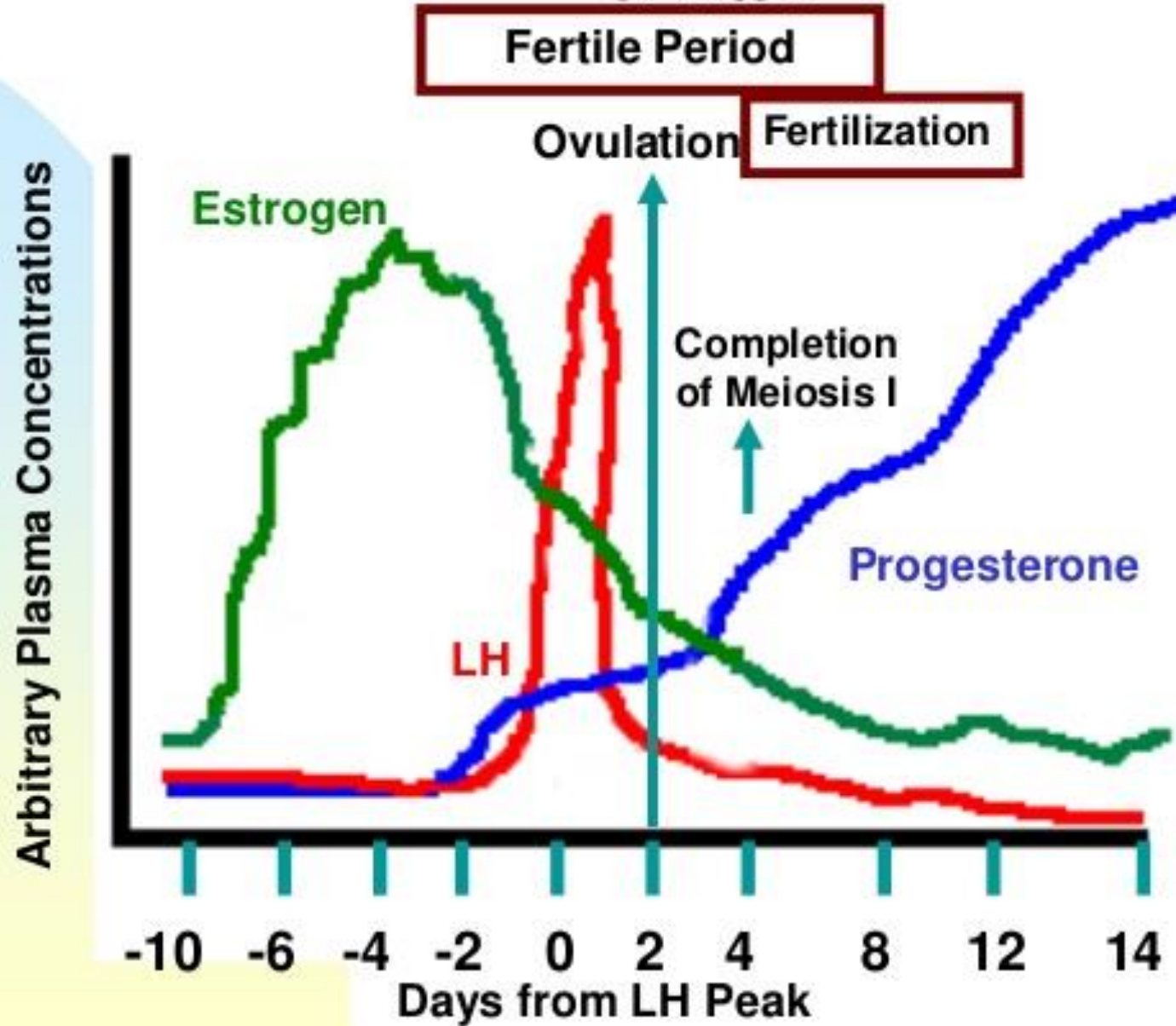


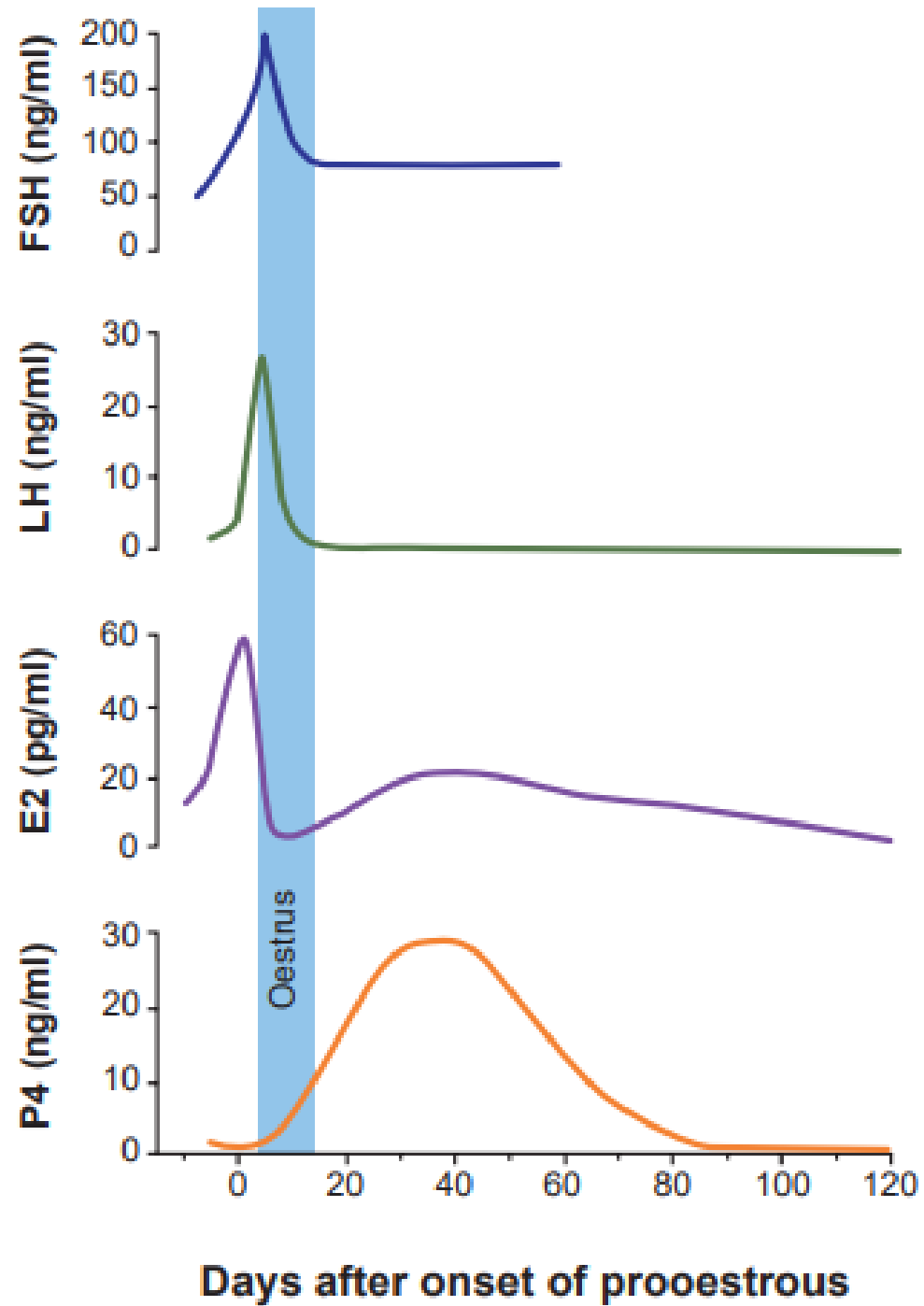
- Estradiol rises rapidly during proestrus and peaks just before the onset of standing estrus; this is accompanied by an increase in androstenedione and testosterone concentrations.
- Estradiol peak occurs on average one day before the LH peak which lasts much longer than that of other species (36 ± 55 hours with ovulation occurring 48 to 60 hours after this).
- Preovulatory LH surge is generally accompanied by the FSH surge, with FSH concentrations reaching a peak at estrus and coinciding with that of LH.

- Peripheral progesterone concentrations continue to increase after ovulation and peak around 25 days after ovulation.
- Prolactin is required in addition to LH to support luteal function in the bitch.
- Prolactin appears to have a negative correlation with progesterone from about 25 days after ovulation.
- Progesterone levels fall towards the end of metestrus or pregnancy, prolactin concentrations increase and therefore maintains the CLs.

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- Prolactin is the major luteotrophic hormone.
 - During pregnancy there is enhanced secretion of prolactin from the placenta, which is responsible for elevated progesterone concentrations in the pregnant bitch compared with nonpregnant counterparts.

Hormonal Patterns During Estrous Cycle of Bitch





ESTROUS CYCLE IN FELINE



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- Females will usually show their first estrus once a **body weight of 2.3 to 2.5 kg** has been attained, at an approximate age of **7 months**.
- Free-living nonpedigree and feral cats are **seasonally polyestrous**, with a period of anestrus beginning in the late autumn.
- Increasing daylight length is the most important factor inducing the resumption of reproductive activity.
- The first estrus usually occurs after the shortest day of the year.
- There may be a period of apparent lack of estrous activity in the early summer.

- Essentially, there are **four possible outcomes** following estrus in the queen:
 1. A mating occurs that induces ovulation (24–36 hours later), CL formation and if there is a fertile mating, then **pregnancy** is likely to occur.
 2. A mating occurs; there is likely to be ovulation, CL formation, but no fertilisation and a **pseudopregnancy** will ensue.
 3. Mating may or may not occur; there may be no ovulation, which will be followed by **follicular regression and atresia** and, after a short interestrus interval of a few days, a return to estrus. In some cases, the interestrus interval is so short that some individuals may appear to be continuously estrus.
 4. At the end of the breeding season, in which there is no ovulation, the queen cat may become **anestrus**.

- Nonpedigree cats have regular estrus cycles lasting approximately 3 weeks, but others may show no regular pattern.
- **Duration of estrus is 5 to 8 days.**
- Estrogen concentrations increase dramatically at the time of estrus from the baseline of 60 pmol/l and may double within 24 hours, reaching a peak of up to 300 pmol/l.
- The rapid rise in estrogen concentrations corresponds to an abrupt appearance of behavioural changes indicative of estrus, and queens do not usually show a distinctive proestrus phase.

Characteristics of estrus:

- Increased vocalization
- Rubbing
- Rolling
- Increased activity
- Adopts mating posture
- Lordosis
- Tail held erect and slightly to one side
- Slight serous vaginal discharge (occasionally)



MATING

- During mating the tom mounts the queen and grasps her neck with his teeth.
- The queen's hind legs paddle as he adjusts his position, and this becomes more rapid during coitus, which lasts up to 10 seconds.
- The queen cries out during copulation, and as the tom dismounts, she may strike out at him, displaying the typical rage reaction.
- This is followed by a period of frantic rolling and licking at the vulva.
- There may be several matings within the first 30 to 60 minutes.



OVULATION

- At estrus, there are 5 to 8 follicles of 3 to 4 cms in diameter at the time of ovulation present in both ovaries.
- The cat is an induced ovulator, and thus mating is important in triggering ovulation.
- Receptors are present within the queen's vulva that are stimulated during copulation.
- This triggers the release of LH from the anterior pituitary.
- Only 50% females ovulate after first mating, multiple matings are required to ensure adequate LH release.

- Ovulatory surge of LH begins within minutes of coitus, peaks within 2 hours and returns to basal values within about 8 hours; peak LH concentrations of greater than 100 ng/ml have been reported.
- Ovulation is an all or nothing phenomenon, occurs 30 to 40 hours after coitus.

