# Physiology of the Female Reproductive system

The periods without regular cyclic activity (anoestrus) constitute the main part of the life of a normal fertile female animal.

(1)The juvenile period and (2)the periods of gestational and (3)lactational anoestrus are much more time consuming than the relatively short periods of cyclic activity.

However most attention is focused on the periods of cyclic activity.

The general principle of the endocrinology of reproduction is the same for the different species, but there are differences between species. Some animals are (1)**poly-oestrus** (cow, swine) during the entire year, others are (2)**seasonally poly-oestrus** (horse, sheep, cat). The dog is

(3)**mono-oestrus.**

Other differences can be found in the type of ovulation. Most animals are (1)**spontaneous ovulators**, but in the cat, rabbit and the camel ovulation is (2)**induced** by stimulation of sensory receptors in the vagina and cervix at coitus.

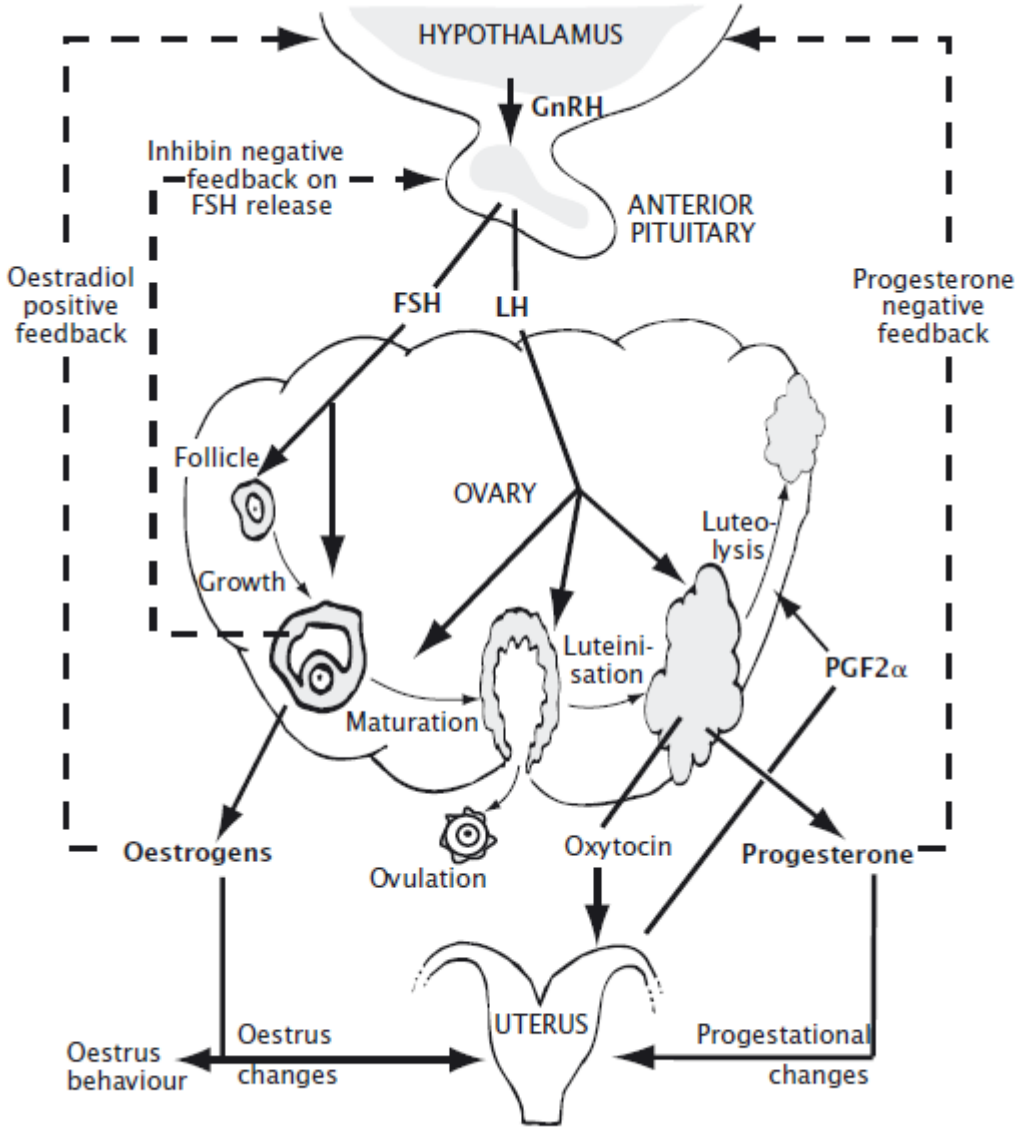
## HORMONAL CONTROL OF REPRODUCTION

(1)**The CNS receives information from the environment** of the animal (external signals: visual, olfactory, auditory, and tactile) and conveys this information, as far as relevant for reproduction, to the gonads through the **Hypothalamo-Pituitary-Gonadal axis**.

The hypothalamus and the pituitary gland are structures that are closely attached to the ventral part of the brain. Both structures are not only producers of hormones, but also target organs, which create a homeostatic feedback system. By this feedback mechanism most hormones regulate their own rate of secretion.

(2)**In the hypothalamus, endocrine neurons produce**, after stimuli from the CNS, Gonadotrophin Releasing Hormone (GnRH). This GnRH

is transported via the hypothalamo-hypophyseal portal system to the anterior lobe of the pituitary gland.




(3) **In the anterior lobe of the pituitary gland, GnRH stimulates the gonadotroph** cells of the pituitary gland to secrete Follicle Stimulating Hormone (FSH) and Luteinising Hormone (LH). GnRH, FSH and LH are released in a pulsatile way.

(a)FSH stimulates the development of ovarian follicles. In the theca interna of the follicle,

(b)LH stimulates the synthesis of androstenedione from cholesterol. Androstenedione is converted into testosterone; that in the granulosa cells of the follicle is aromatised to oestradiol-17_ under the influence of FSH.

(4)**Oestradiol has a positive feedback on the hypothalamus** and pituitary gland. It increases the frequency of the GnRH pulses. Above a certain threshold level of oestradiol, the hypothalamus responds with a surge of GnRH. This GnRH surge induces an LH surge that initiates ovulation.

The other principal effect of oestradiol is the induction of oestrus symptoms. **Oestrus** can be described as the behavioral and physical symptoms that signal to other animals that the female is in its fertile phase and will allow mating.

(5)**The granulosa cells also produce inhibin**. Not all effects of this hormone are understood, but it received its name because of its negative feedback on the FSH release from the pituitary gland, thus controlling follicle development.

(6)**After ovulation the remnants** of the follicle are remodelled into the corpus luteum under the influence of LH. The cavity of the follicle is filled with blood vessels, and the granulosa cells increase in size. The corpus luteum is mainly a secretory organ that produces progesterone and oxytocin.

(7)**Progesterone is essential** for the normal cycle in the cow, and after conception it is the principal hormone responsible for the maintenance of pregnancy. (a)It decreases the GnRH pulse release, and therefore inhibits new ovulations.

Furthermore, (b)it prepares the endometrium for the nidation of the developing embryo, and inhibits uncontrolled contractions of the uterine wall.

(8)**If the ovum that is released from the follicle during ovulation, is not fertilized**, the animal will not receive a signal of pregnancy from the embryo. At around day 16 after ovulation, the endometrium of the non-pregnant uterus will **release prostaglandin F2_.**

PGF2_ is luteolytic, which means that it initiates the regression of the corpus luteum.

The luteolytic mechanism of prostaglandins is not completely elucidated, but it involves a reduction of the blood supply of the corpus luteum by vasoconstriction and a direct effect of prostaglandin F2_ on the luteal cells.

**Oxytocin produced in the corpus luteum** is also thought to play a role in luteolysis.

(9)As a result of the regression of the corpus luteum, progesterone concentrations in the blood will decrease, and the progesterone block on the GnRH release from the hypothalamus disappears. This initiates a new follicular phase and the final development of a pre-ovulatory follicle.