Endocrinology of Reproduction

The major function of the reproductive system is to ensure survival of the species. Other systems in the body, work continuously to maintain homeostasis for survival of the individual.

The reproductive system has four functions:

- To produce gametes (egg and sperm cells).
- To transport and sustain these gametes
- To foster the developing offspring
- To produce hormones

These functions are divided between the primary and secondary, or accessory, reproductive organs.

- The primary reproductive organs, or gonads (ovaries and testes).
- These organs are responsible for producing the gametes (eggs and sperms) and hormones.
- These hormones function in the maturation of the reproductive system, the development of sexual characteristics, and regulation of the normal physiology of the reproductive system.
- All other organs, ducts, and glands in the reproductive system are considered secondary, or accessory, reproductive organs.
- These structures transport and sustain the gametes and nurture the developing offspring.
- The endocrine system, along with the nervous system, functions in the regulation of body activities.
- The nervous system acts through electrical impulses and neurotransmitters to cause muscle contraction and glandular secretion.
- The endocrine system acts through chemical messengers called hormones that influence growth, development, and metabolic activities.
- The action of the endocrine system is measured in minutes, hours, or weeks and is more generalized than the action of the nervous system.

Chemical Nature of Hormones

Hormones can be grouped into three main types:

- **amines**, these are simple molecules
- **proteins and peptides** which are made from chains of amino acids
- **steroids** which are derived from cholesterol.
- All of the hormones in the human body, except the sex hormones and those from the adrenal cortex, are proteins or protein derivatives.

Mechanism of Hormone

- Hormones are carried by the blood throughout the entire body but they affect only certain cells.
- The specific cells that respond to a given hormone have receptor sites for that hormone. This is sort of a lock-and-key mechanism. If the key fits the lock, then the door will open.
- All the cells that have receptor sites for a given hormone make up the target tissue for that hormone.
- Protein hormones react with receptors on the surface of the cell, and the sequence of events that results in hormone action is relatively rapid.
- Steroid hormones typically react with receptor sites inside a cell, so it is relatively slow.

There are two major categories of glands in the body:

Exocrine Glands

- Exocrine glands have ducts that carry their secretory product to a surface.
- These glands include the sweat, sebaceous, and mammary glands and, the glands that secrete digestive enzymes.

Endocrine Glands

- The endocrine glands do not have ducts to carry their product to a surface, so they are called ductless glands.
- The secretory products of endocrine glands are called hormones and are secreted directly into the blood and then carried

throughout the body where they influence only target organs that have receptor sites for that hormone.

All hormones of the animal's body are involved in the process of reproduction either directly (primary) or on directly (secondary).

I. The primary hormones of reproduction are directly related to the reproductive processes such as folliculogenesis and follicular growth, oogenesis and ovulation in females; spermatogenesis, secondary sexual characteristics, fertilization, maintenance of pregnancy, parturition and lactation as well as the maternal behaviour of the mother animals.
II. The secondary hormones of reproduction are necassry for the general wellbeing (welfare) and metabolic conditions permit the occurrence and continuation of reproduction

Control of Hormone Action

- Hormones are very potent substances, which means that very small amounts of a hormone may have profound effects on metabolic processes.
- Because of their potency, hormone secretion must be regulated within very narrow limits in order to maintain homeostasis (stability) in the body.

Mechanism of hormone action

There are two mechanisms

Feedback mechanism

- Ovarian functions are controlled by the secretion of FSH and LH from the anterior pituitary gland.
- The anterior pituitary gland responds to the stimulation of the releasing hormone (GnRH) from the hypothalamus
- FSH stimulate the follicular growth and consequently estrogen (Oestradiol 17 Beta) production from the granulosa cells.
- When the oestradiol level increased to certain level, it selectively inhibits the release of FSH through both its positive feedback and stimulation the release of inhibin hormone.

- Also, progesterone hormone when reach to certain level exerts its negative feedback on the hypothalamus to stop the release of GnRH.

Neuro-Humoral mechanism

- Neurohumoral impulse reach the hypothalamus stimulate it to release GnRH especially in animals with induced ovulation such as cats, rabbit, she-camel, as the ovulation process occurs as a result to the act of coitus through mechanical penile stimulation of the cervix which send neurohumoral impulse to the hypothalamus which in turn secrete GnRH causing release of both FSH and LH which is required for ovulation.
- Another example: In mammals, due to the act of natural mating or introduction of the AI catheter in the cervix, which in turn send a neurohumoral impulse to the posterior pituitary gland to release oxytocin causing contraction of the smooth muscle of the vagina and cervix that permit (facilitate) the sperm passage to the site of fertilization at the ampullary isthmic junction of the oviduct.

Endocrine Glands

- Although there are eight major endocrine glands scattered throughout the body, they are still considered to be one system because they have similar functions, similar mechanisms of influence, and many important interrelationships.
- Some glands also have non-endocrine regions that have functions other than hormone secretion. For example, the pancreas has a major exocrine portion that secretes digestive enzymes and an endocrine portion that secretes hormones.
- The ovaries and testes secrete hormones and also produce the ova and sperm.
- Some organs, such as the stomach, intestines, and heart, produce hormones, but their primary function is not hormone secretion.

Hypothalamus

It is connected to the anterior pituitary gland through the hypophyseal portal blood system

Pituitary Gland

- It is known as the **"master gland"** because it exerts control over all of the other glands of the endocrine system.

- The pituitary gland (hypophysis) is a small gland about 1 centimetre in diameter or the size of a pea.
- There are two distinct regions in the gland: the anterior lobe (adenohypophysis) which is an outgrowth of the pharynx and the posterior lobe (neurohypophysis) which is an outgrowth of the brain composed of neural (nerve) tissue.
- The activity of the adenohypophysis is controlled by releasing hormones from the hypothalamus.
- The neurohypophysis is controlled by nerve stimulation.
- **The Anterior Lobe** of the pituitary plays the 'master' role secreting six major hormones that affect most of the body, including the other endocrine glands:

- **Growth hormone (GH) a**lso known as somatotrophic hormone is responsible for the growth of long bones, muscles and viscera.
- **ACTH** (Adrenocorticotrophic hormone) stimulates the adrenal glands to secrete its hormones.
- **Thyroid stimulating hormone** (**TSH**) influences the structure of the thyroid and causes it to secrete thyroid hormone.
- **Follicle stimulating hormone** (**FSH**) stimulates female egg production or male sperm production.
- **Prolactin** (**PRL**) in females causes the corpus luteum the area around the mature follicle to produce two important hormones: Oestrogen and Progesterone. During pregnancy PRL is also responsible for the development of the glandular tissues of the breast which produce milk.
- **Luteinizing hormone** (**LH**) works in conjunction with FSH in females to cause ovulation and prepares the uterus for pregnancy, in males the testes to secrete testosterone.
- **The Posterior Lobe** of the Pituitary Gland (or neurophpophysis) stores and releases hormones secreted by the hypothalamus section of the brain including:
- **Antidiuretic hormone (ADH)** increases the kidney's permeability to water allowing the body to re-absorb water that would otherwise escape in urine.
- **Oxytocin** (**OT**)
- Stimulates the smooth muscles of the uterus during pregnancy, causing it to contract during labour.
- It also stimulates the lacteals (milk ducts) in the udder.

Pineal Gland

- Also called pineal body or epiphysis cerebri
- The pineal gland consists of portions of neurons, neuroglial cells, and specialized secretory cells called pinealocytes.
- The pinealocytes synthesize the hormone melatonin and secrete it directly into the cerebrospinal fluid, which takes it into the blood. Melatonin affects reproductive development and daily physiologic cycles.

Thyroid Gland

- It secretes thyroxine (95%) and triiodothyronine (5%) hormones. Both of these require iodine for their synthesis.
- Calcitonin is secreted by the parafollicular cells of the thyroid gland. This hormone opposes the action of the parathyroid glands by reducing the calcium level in the blood. If blood calcium becomes too high, calcitonin is secreted until calcium ion levels decrease to normal.

Parathyroid Gland

- It secretes parathyroid hormone or parathormone. Parathyroid hormone is the most important regulator of blood calcium levels. The hormone is secreted in response to low blood calcium levels.
- Hypoparathyroidism, or insufficient secretion of parathyroid hormone, leads to increased nerve excitability. The low blood calcium levels trigger spontaneous and continuous nerve impulses, which then stimulate muscle contraction

The Adrenal Glands

- The adrenal, or suprarenal, gland is paired. Each gland is divided into an outer cortex and an inner medulla.
- The cortex and medulla of the adrenal gland, like the anterior and posterior lobes of the pituitary, develop from different embryonic tissues and secrete different hormones. The adrenal cortex is essential to life, but the medulla may be removed with no life-threatening effects.
- The adrenal cortex is regulated by negative feedback involving the hypothalamus and adrenocorticotropic hormone; the medulla is regulated by nerve impulses from the hypothalamus.

Hormones of the Adrenal Cortex

- The adrenal cortex consists of three different regions, with each region producing a different group or type of hormones.
- Chemically, all the cortical hormones are steroid.

- It is essential for life, as opposed to the adrenal medulla which is important but not indispensable.
- The anterior pituitary controls the adrenal cortex by secreting the hormone ACTH.
- All of the secretions of the adrenal cortex are known as steroids, many of which can now be manufactured synthetically.
- The adrenal cortex is made up of three layers associated with three classes of hormones:
- **Mineralocorticoids** are produced by the outer layer of the adrenal cortex, the most important of which is aldosterone. Aldosterone promotes the retention of sodium (Na+) and the excretion of potassium (K+). This helps to maintain both the electrolyte and water content of the body.
- **Glucocorticoids** are produced by the middle cortex. These affect almost every cell in the body regulating the metabolism of fats, proteins, and carbohydrates.
- The principal glucocorticoid is cortisol, which increases blood glucose levels
- **Gonadal hormones** are produced by the inner cortex, there are roughly even amounts of two types of hormones secreted: Androgen (male) and Estrogen (female).
- Male hormones, androgens, and female hormones, estrogens, are secreted in minimal amounts in both sexes by the adrenal cortex, but their effect is usually masked by the hormones from the testes and ovaries.
- In females, the masculinization effect of androgen secretion may become evident after menopause, when estrogen levels from the ovaries decrease.

Hormones of the Adrenal Medulla

- It is the inner part of the adrenal gland.
- These two hormones are secreted in response to stimulation by sympathetic nerve, particularly during stressful situations.
- A lack of hormones from the adrenal medulla produces no significant effects. Hypersecretion, usually from a tumor, causes prolonged or continual sympathetic responses.
- They are both associated with an increased heartbeat, higher blood pressure, and higher blood glucose levels, thus preparing the body for quick action.
- **Adrenalin** (or epinephrine) affects both alpha and beta receptors in the nervous system.

- **Noradrenalin** (Norepinephrine) affects only the alpha receptors of the nervous system.

The Gonads

- Are the primary reproductive organs
- The gonads consist of ovaries in the female and testes in the male.
- These organs are responsible for producing the sperm and ova (exocrine function).
- These glands produce hormones important in the development and functioning of the reproductive organs. they are under the control of the pituitary gland, and produce the secondary sexual traits.
- **The Testes** serve two main functions: (i) The production of sperm cells, and (ii) The secretion of testosterone.
- A small amount of testosterone is also produced by the adrenal cortex.

The testosterone is responsible for:

- Testosterone is the masculizing hormone inducing male secondary sexual characteristics after puberty
- The growth and development of the male reproductive structures
- Increased skeletal and muscular growth
- Enlargement of the larynx accompanied by voice changes
- Growth and distribution of body hair
- Increased male sexual drive
- Testosterone secretion is regulated by a negative feedback system that involves releasing hormones from the hypothalamus and gonadotropins from the anterior pituitary.

The Ovaries

- They have three main functions; (i) Containing immature ova (eggs), (ii) The secretion of oestrogen, and (ii) the secretion of progesterone.
- These steroid hormones contribute to the development and function of the female reproductive organs and sex characteristics.
- **Estrogen** is secreted by the adrenal cortex as well as the ovaries.
- **Estrogen and progesterone** both are responsible for Maturation of reproductive organs.
- This induces and maintains female secondary sexual characteristics.
- **Progesterone** works on the uterus to prepare it for the implantation of a fertilised ovum (egg).

- **Estrogen** responsible for the development of the duct system of mammary gland, while progesterone is responsible for development of the alveolar system
- **Progesterone** causes the uterine lining to thicken in preparation for pregnancy.

Other Endocrine Glands

The placenta develops in the pregnant female as a source of nourishment and gas exchange for the developing fetus. It also serves as a temporary endocrine gland. One of the hormones it secretes is human chorionic gonadotropin, which signals the mother's ovaries to secrete hormones to maintain the uterine lining so that it does not degenerate and slough off in menstruation.

Primary Hormone of Reproduction

Anterior pituitary Hormones

- FSH, LH (ICSH in males), prolactin (lactogenic) or Luteotropic hormone (LTH).
- These hormones are protein in nature, so they are not given per os (digested by proteolytic enzymes).
- Repeated administration of these hormones results in formationof antibodies which will neutralize the injected hormones.
- These hormones are difficult to be manufactured, so they are only obtained from their biological sources such as pregnant mare serum (equine chorionic) gonadotropin, human chorionic gonadotropin, urine of menopausal women or from the pituitary glands of sheep, goats and pigs.

Follicle Stimulating hormone (FSH)

- Its secretion is under the effect of GnRH from the hypothalamus.
- Also, it is regulated through both the negative feedback of progesterone and estrogen (through release of inhibin).
- Season of the year and daylight length affect the secretion of FSH through stimulation of some receptors in the retina of the eye (optic nerve).
- It stimulates growth and maturation of the immature and Graafian follicles and stimulate seminiferous tubules and the spermatogenesis process in males.

Luteinizing hormone (LH) or (Interstitial cell stimulating hormone ICSH in males)

- Its secretion is under the effect of GnRH from the hypothalamus.
- Also, it is regulated through both the negative feedback of progesterone and positive feedback of estrogen.

- It has three main functions in females: Maturation of preantral follicles, Ovulation and CL formation and consequently progesterone production.
- In males, it stimulates the interstitial cells (Leydig cell) which secrete testosterone hormone

Prolactin (lactogenic) or Luteotropic hormone (LTH)

- It maintains the growth of corpus luteum and stimulate the secretion of progesterone.
- It initiates lactation after parturition.
- It stimulates the crop in birds to secrete crop milk
- It stimulates the maternal behaviour of both animals and birds

Posterior pituitary hormones

Oxytocin

- Oxytocin causing contraction of the smooth muscle of the vagina, cervix and oestrogenised uterus at the time of estrus phase that permit (facilitate) the sperm passage to the site of fertilization in the ampullary isthmic junction of the oviduct.
- Stimulates contractions of the smooth muscles of the estrogen impregnated uterus at the time of parturition causing delivery of the fetus.
- It also stimulates the lacteals (milk ducts) in the udder through its effect on the myoepithelial cells around the alveoli.
- Suckling or milking stimulate sensory nerve ending which conduct impulses to the hypothalamus with a subsequent release of oxytocin causing or facilitate milk let down.
- Oxytocin is used clinically in case of dystocia due to primary uterine inertia, stimulation of the uterus and occasionally to induce ovulation.

Vasopressin

- It stimulates contractions of the smooth muscle fibres of the arterioles.
- It is used clinically to stop bleeding postpartum

Biological sources of GnRH

- Are known as non-pituitary gonadotropins or anterior pituitary like hormones

Equine chorionic gonadotropins (eCG)

- Pregnant mare serum gonadotropins (PMSG) recently equine chorionic gonadotropins (eCG) from the endometrial cups of

pregnant mares between 40 and 140 days and reach its peak at 80 days of gestation.

- eCG is mainly FSH like hormone but it has some LH activity.
- eCG causing development of multiple follicles which ovulate forming multiple corpora lutea called accessory corpora lutea (help in maintain of pregnancy).
- The gonads of the fetus are also stimulated since the hormone passes across the placental barrier.
- eCG is used to induce follicular growth in case of ovarian inactivity; in cows estrus and ovulation occurs within 2-5 days after single IM dose of 1500 I.U. While in mares estrus appears within 5-8 days followed by ovulation.
- eCG also used to induce superovulation in donor cows in case of embryo transfer programme (3000 I.U is given I.M during the midluteal phase i.e between day 8 and 12 of the cycle).
- Repeated injection of eCG may results in anaphylactic shock due to the forigen protein nature of the hormone
- GnRH could be obtained from extracts of the pit. G. of sheep and pigs, but characterised by a short half-life in cows (about 5 hours). So, a total dose of 36 mg is used IM on 4 successive days in a reducing manner (i.e. 6,6-5,5-4,4-3,3) for induction of superovulation.

Human chorionic gonadotropins (HCG).

- It is prepared commercially from urine of pregnant women.
- It has mainly LH like activity with some FSH like action.
- The source of HCG is the cytotrophoblast of the chorionic villi of the placenta.
- The hormone appears in the urine of the pregnant women within few weeks after conception and reaches its peak at about 50 days of pregnancy, then decreases gradually.
- It is clinically used to treat follicular theca cyst causing luteinization of the granulosa cells to lutein cells
- It is used for the treatment of delayed ovulation and anovulation.
- It is used also in cases of habitual abortion as it stimulate the CL to produce sufficient progesterone.
- In males, it is used to increase libido through stimulation of the Leydig cells to produce androgen.

Ovarian Hormones

Estrogens

- Mainly in the form of estradiol, estron and estriol, are steroid in nature.

- Estrogens are produced in the Graafian follicles (granulosa and theca interna cell) under the effect of FSH and small amount of LH during proestrus and estrus phases.
- Estrogen are found in the urine of pregnant mares at about 100-120 days of pregnancy, and in the urine in the pregnant women, placenta and amniotic fluids.
- In male estrogens are secreted by the sertoli cells and adrenal cortex.
- It is responsible for the clinical and nervous signs of estrus.
- It causes development of secondary sexual characteristics
- Near ovulation, estrogen reach its peak level causing suppression of the FSH release (inhibin selectively inhibits FSH secretion not LH), and LH reach a surge sufficient to induce ovulation.
- Estrogens increase the vascularity, edema and hyperaemia of the genital tract during estrus.
- It stimulates contraction of the oviduct toward the ovaries during estrus and causing the cilia to beats toward the ovaries facilitate sperm transport.
- It increases the deposition of glycogen in the endometrial glands.
- It stimulates proliferation of the duct system of the mammary gland.
- It stimulates cervical secretion and open the cervical canal during estrus.
- It stimulates softening and relaxation of the pelvic ligament just before parturition.
- It prepares the uterus for the action of oxytocin.
- It has marked anabolic effect.
- It causes rapid proliferation of the epithelial layers of the vagina, and in some species (bitch) it causes keratinization of the vaginal epithelial mucosa
- Estrogen is used either in the form of estradiol (natural source) or stibestrerol (synthetic form from coal tar).
- The naturally occurring estrogen (estradiol) is 10 more potent compared with synthetic form (stibestrerol).
- Estrogen increase the phagocytic activity of uterus through increasing its vascularity and hyperaemia.
- Estrogen has a bacteriostatic effect.
- Estrogen is clinically used to evacuate the uterine content (pus).
- Small repeated dose (5 mg) has a luteolytic effect so it is used in case of anoestrus animals

- In prostate hypertrophy in dogs, estrogen is given to inhibit FSH as well as testosterone production.
- Estrogen is used to induce mammary gland development and lactation in virgin heifers and dry cows.

Drawback of misusing Estrogens

- Excessive or prolonged use of estrogens is contraindicated as it may leads to:
- Cystic ovaries
- Relaxation of the pelvic ligaments predisposing to vaginal and rectal prolapse.
- Inhibit lactation in lactating animals.
- It has a carcinogenic predisposition

Progesterone

- ✓ It is steroid in nature and produced mainly by the corpus luteum under the effect of both LH and LTH.
- ✓ The placenta produces certain amount of progesterone.
- ✓ It is prepared synthetically from soybean wax.
- ✓ It stimulates growth of the endometrial glands in a uterus previously stimulated by estrogen.
- ✓ It stimulates the growth and development of the alveolar system of mammary gland.
- ✓ It inhibits the uterine contraction, and inhibit the response of the uterus to the action of oxytocin so it maintains pregnancy (make the uterus calm and flaccid).
- ✓ It Increases the tonicity of the cervix and viscosity of the cervical secretions enhance forming of the cervical plug during pregnancy.
- ✓ Progesterone when injected early in estrus, it inhibits ovulation.
- ✓ Progesterone has a negative feedback effect on the hypothalamus and pituitary glands.
- ✓ It is used to treat habitual abortion.
- ✓ Progesterone is used for synchronization of estrus.

Relaxin

- It is produced by the CL during the late stage of pregnancy.
- The uterus and placenta possible secret relaxin in some species.

- The action of relaxin is intimately (closely) associated with estrogen and progesterone.
- It causes relaxation of the pelvic ligaments and softening of the pelvic symphysis at parturition.
- It inhibits uterine contractions during pregnancy.
- It induces dilation of the cervix at parturition.

Bradykinin

The hormone is present in the follicular fluid.

It causes relaxation of the wall of fallopian tube after ovulation.

Hormones of Pregnancy

- The main source of progesterone for maintenance of pregnancy in the cow is the CL, while the placenta secrets small amounts.
- Progesterone concentrations increase gradually during pregnancy and reach its peak after 2 months and starts to decline about 20 days prepartum.
- Estrogen concentrations during early and mid-gestation are low.
- Towards the end of gestation, estrogen levels increase and reach it peak level 2-5 days before parturition.
- Both FSH and LH concentrations remains low during pregnancy.
- Prolactin remain low during pregnancy, but increases gradually shortly before parturition.
- Relaxin and oxytocin are low during pregnancy, but increases gradually to ward the end of gestation.

Inhibin

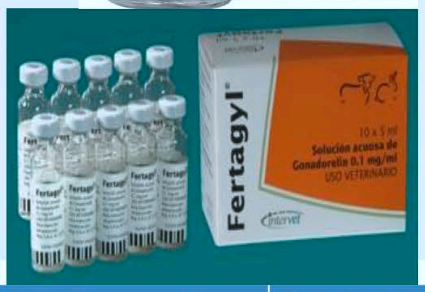
- It is protein in nature.
- It is secreted from the mature graafian follicle (Granulosa cells) and Sertoli cells.
- It is selectively inhibit the secretion o FSH.

Pheromones

- Sex pheromones are chemical substances secreted from modified sebaceous and sweat skin glands.
- The perineal region and external genitalia are common sources
- The genital secretions and urine contain sex pheromones in sexually mature animals, and more concentrations are present at estrus.

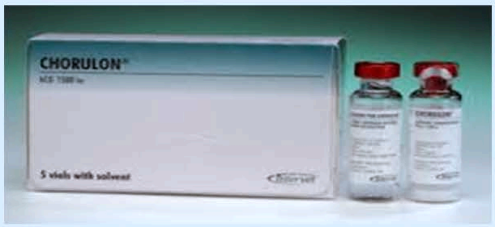
Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
Gonadotropin releasing hormone (GnRH)	neuropeptide	Hypothalamic surge and tonic center	Anterior lobe - pituitary	Release of FSH and LH from anterior lob-pituitary	Fertagyl receptal cystoreline

used 1 – treatment of ovarian follicular cysts.
2 - treatment of inactive ovaries
3 - treatment delayed ovulation and ovulation.
4 - in Estrus synchronization
5 -Gonadorelin: cow, 0.5 mg i.m., s.c. or i.v.
6- Fertirelin: cow, 100 µg i.m.
7- Buserelin: cow, 10–20 µg; horse 40 µg i.m



Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
Luteinizing hormone (LH)	glycoprotein	Anterior lobe (pituitary)	Ovary theca interna and luteal cell	1. Follicle Maturation 2. Ovulation 3. Cl formation 4. Progesterone release 5. Testosterone release	Chorulon follutein

Biological source hCG(human chorionic gonadotropine) or PLH
Used 1 – treatment cystic ovary
2 –before estrous to ovulation , delayed ovulation , anovulation
3 - after insemination to increase size CL to increase progesterone
4 –super ovulation
5 - in embryo transfer to estrous synchronization



Dose:
1- Cattle &horse: 1500-3000 IU i.m.
2- Sheep and goat, 100–500 IU i.m. or i.m.

Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
Follicle stimulating hormone (FSH)	glycoprotein	Anterior lobe (pituitary)	Ovary granulosal cells	1. Follicle growth 2. Estrogen release 3. Spermatogenesis	Folligon Gonadin

Biological source PMSG(pregnant mare serum gonadotropin) or PFSH (New name eCG)

Used 1 –treatment inactive ovaries

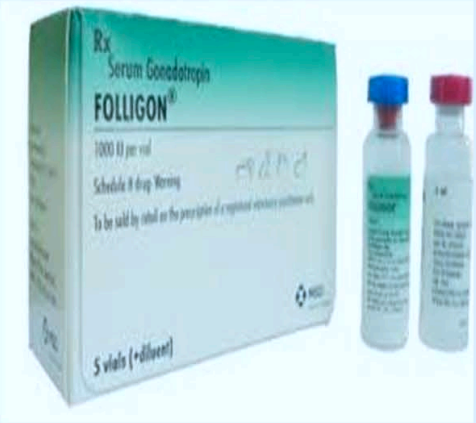
2 – super ovulation

3 – estrous synchronization

Dose

1 – cattle : 1500- 3000 IU i.m.,s.c.

2 – sheep and goats 500 -800 IU i.m., s.c.



Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
Prolactin	protein	Anterior lobe (pituitary)	Mammary cells	Lactation material behavior	prolactin Bromocriptine (prolactin antagonist)
Prolactin releasing factor PRF	Peptide	Hypothalamus	Anterior Pituitary	Prolactin release	
Prolactin inhibiting factor PIF		Hypothalamus		Prolactin retention	

used 1 – in start and continue the lactation(induce lactation)

2 - maternal instinct and brooding in some species

Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Economic name
oxytocin	neuropeptide	Synthesized in the hypothalamus , stored in the posterior lobe , synthesized by CL	Myometrium and endometrium of uterus myoepithelial cell of Mammary gland	Uterine motility , promotes uterine PGF2 synthesis, milk ejection	Oxytocin pitocin

used 1 – in dystocia
2 – retained fetal membrane
3 –pyometra
4 – milk ejection
5 –induction of abortion in mare

Dose:
1- Cattle: 50-100 I.U.
2- Sheep and Goats: 40 I.U.

Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
estradiol	Steroid	Granulose cell of follicle ,placenta ,sertoli cells of testis	Hypothalamus , entire reproductive tract and mammary gland	sexual behavior , GNRH, elevated secretory activity of the entire tract, unhanded uterine motility	Estradiol benzoat

used 1 – retained fetal membrane
2 – uterine inflammation
3 – induction abortion
4 – mummified fetuses
5 – prevent fertilization and pseudo pregnancy in bitch

dose 1 -15 mg from estradiol
10 -150 mg from stibesterol

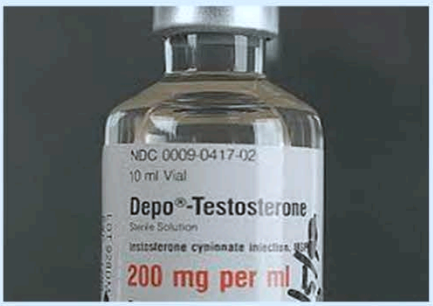
Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
Progesterone	Steroid	Corpus luteum and placenta	Uterine endometrium , mammary gland , myometrium ,hypothalamus	Endometrium secretion, inhibition GNRH release, inhibition reproductive behavior , promotes maintenance of pregnancy	CAP , MAP ,MGA, natural in vaginal device

used 1 – estrous synchronization
2 – treatment repeat abortion
3- decrease signs of estrous in follicular cyst (nymphomania)
use nymphalon (HCG +Progesterone)

Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
testosterone	Steroid	cells of theca interna	Brain , skeletal muscle , granulosal cells	Substrate for E2synthesis ,abnormal masculinization(hair patterns , voice , behavior ,ect)	Testosteron propionate

used 1 – preparation teaser in estrous detection
2 – steer fatting (anabolic effect)

Dose 50 -500 mg



Name of hormone	Biochemical classification	source	Female target tissue	Female primary action	Commercial name
Prostaglandin PGF2<	Fatty acid	Uterine endometrium vesicular glands	Corpus luteum , uterine myometrium , ovulatory follicles	Luteolysis , promotes uterine tone and contraction , ovulation	prosolivin estrumate lutalyse lupnosteole

Used 1 –dystocia (primary uterine inertia)
2 –induction of abortion and parturition
3 – estrous synchronization
4 – treatment pyometra
5 – treatment luteal cyst

Dose
Cattle:15 – 25 mg
Sheep&goats: 7.5 – 10 mg