CHAPTER-11

Importance and Role of Hormones Involved in Animal Reproduction –

FSH, LH, estrogen, progesterone, testosterone, oxytocin, prostaglandin etc.

Objectives

1. To understand what are hormones.
2. To know what are the major hormones that control reproduction in dairy animals.

Introduction

Reproduction in animals is regulated by the endocrine system. Hypothalamic, pituitary and gonadal hormones regulate the entire process of reproduction in animals. The major reproductive hormones are Gonadotropin releasing hormone (GnRH), follicle stimulating hormone (FSH), leutinizing hormone (LH), estrogen, progesterone and prostaglandins. This chapter deals with the major hormones that control reproduction process in dairy animals.

What are hormones and how they act on the body?

Hormone is a substance produced in one tissue, excreted into the blood and transported by the vascular system to a distant target tissue, where it exerts its effect. The glands producing hormones are called as endocrine glands. Endocrine glands are ductless glands and their secretions are directly dropped into the circulatory system (Exocrine glands are connected by a duct to the target tissue). Based on the chemical structure, hormones are classified into three classes viz protein or polypeptides, steroids and fatty acids. Under normal conditions, the target organ regulates release of a hormone in a feedback manner. Once released, the hormone binds to its receptor and activates series of responses in the target cells like cell multiplication, synthesis of a specific enzyme or release of secretory product. The receptor proteins for hormones are located either on the surface (protein hormones) or in the nucleus (steroid hormones) of the target cells depending upon the type of hormone. Binding with specific blood target proteins transports steroid hormones in the blood from the site of secretion to the target cells.

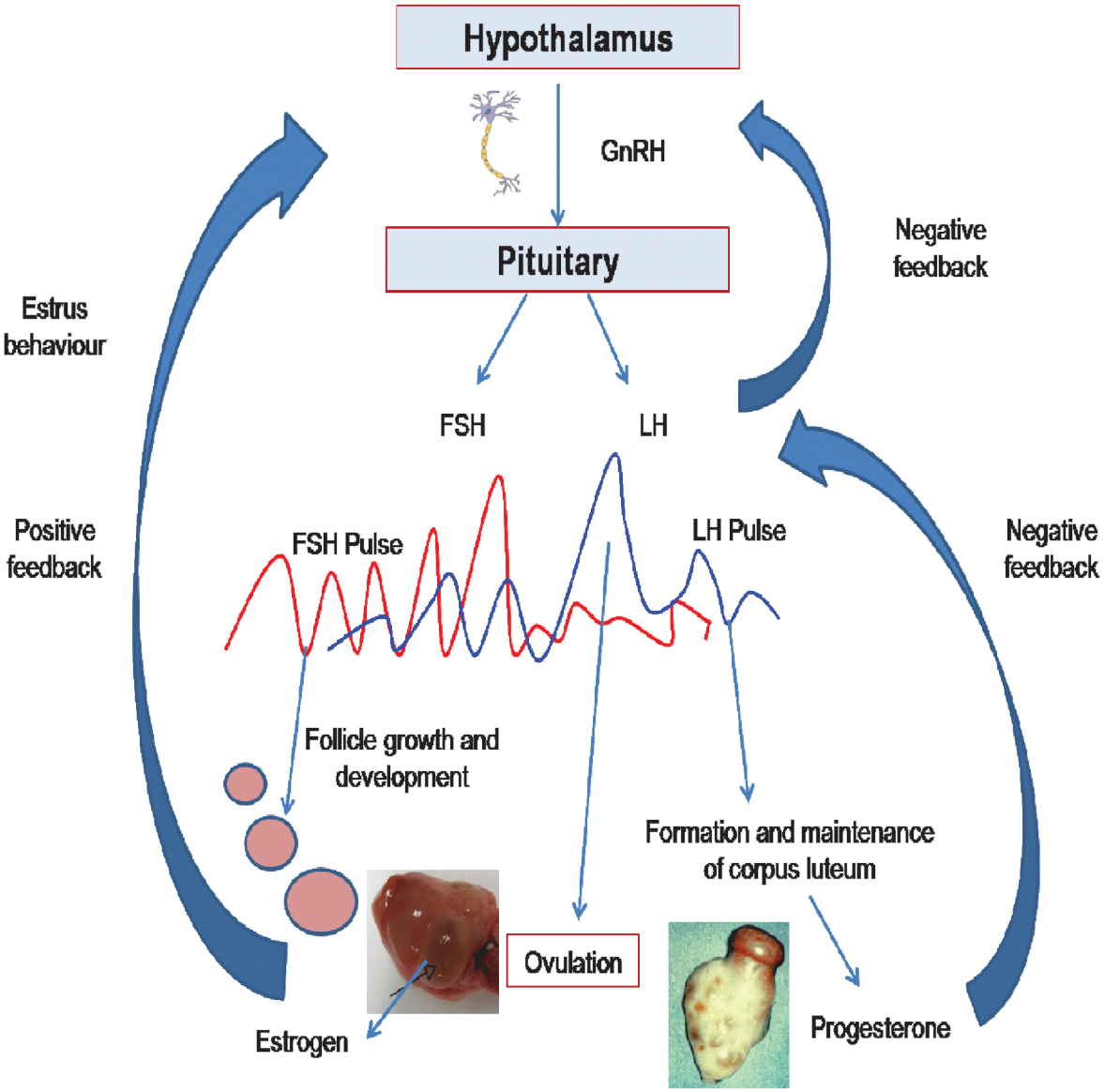

Figure: Hormones of reproduction and their inter play

Table: Major hormones and their usage in management of reproductive disorders in dairy cattle and buffaloes

Hormone	Origin	Major functions	Indications for use
Gonadotropin Releasing Hormone (GnRH)	Hypothalamus	Stimulates the release of both LH and FSH from the pituitary gland.	Anestrus Delayed ovulation Anovulation Suspected cases of luteal insufficiency Follicular cyst
Luteinizing Hormone (LH)	Anterior pituitary	Along with FSH and estrogen, causes final development of the follicle. Pre-ovulatory surge of LH during estrus induce ovulation of the follicle. Stimulates progesterone secretion by the corpus luteum.	Delayed ovulation Anovulation Suspected cases of luteal insufficiency Follicular cyst
Follicle stimulating hormone (FSH)	Anterior pituitary gland	Stimulates growth of antral follicles. Stimulates estrogen production by granulosa cells In conjunction with estrogen, induces LH receptors in granulosa cells in follicles destined to ovulate. Secondary FSH surge after estrus may recruit small follicles into the growing phase.	Anestrus
Estrogen	Follicle Placenta	Acts on the hypothalamus to cause estrous behavior. In conjunction with FSH, induces LH receptor formation on granulosa cells of follicles destined to ovulate. Increased levels induce pre-ovulatory LH surge for ovulation. Stimulates uterine secretions and activity and help in ovum and sperm transport during estrus. Promotes growth of the mammary duct system.	Banned in many countries for usage in animals, however it can be used in the following conditions. Mummification Estrus induction protocols (Heat synch)

Progesterone	Corpus luteum (CL)	Suppresses the frequency of gonadotropin (LH and FSH) releases to prevent ovulation. Stimulates uterine milk secretions to aid in nourishment of pre-implantation embryos. Depresses smooth muscle activity in the reproductive tract. Development of the clusters of milk-secreting alveoli on the mammary ducts.	Suspected cases of luteal insufficiency Threatened abortion Habitual abortion Pre-partum vaginal prolapse Anestrus
Prostaglandin F_2 alpha	Uterus	Regression of the corpus luteum. Contraction of uterine muscles Ovulation	Fixed time insemination in repeat breeders, silent heats Luteal cyst Induction of parturition Estrus induction and synchronization Mucometra Pyometra Endometritis Persistent corpus luteum Retention of fetal membranes (RFM)
Oxytocin	Hypothalamus (stored in the posterior pituitary) and specific cells of the corpus luteum	Stimulates milk let-down Causes smooth muscle contractions in the reproductive tract to aid in sperm, ovum transport and expulsion of the fetus and fetal membranes. May be involved in luteal function and/or regression.	RFM Repeat breeding (after insemination) Uterine inertia
Relaxin	Corpus luteum (ovary)	At the end of pregnancy, stimulates ripening and opening of the cervix and relaxation of the pelvic ligaments.	Not commercially available

Activity

1. Collect the literature for different hormones from the medical shops and paste their labels in work sheet
2. Go to nearest Veterinary hospital and see how hormones are being used

Review Questions

1. What are the hormones secreted by the ovary?
2. Name two releasing hormones from anterior pituitary