HORMONES, GROWTH FACTORS AND REPRODUCTION

Reproduction is controlled by:

1. Hypothalamus, Part of brain
2. Hypophysis, or Pituitary located in Sella turcica
3. Pineal gland,
4. Gonads,
5. Uterus,
6. Placenta,
7. Growth factors and
8. Autocrine and Paracrine systems

Both the endocrine and nervous systems function to initiate, coordinate or regulate the functions of reproductive system.

Endocrine system uses chemical messengers or hormones to regulate reproduction.

HYPOTHALAMUS

1. It occupies only a very small portion of the brain,
2. It consists of region of third ventricle, extending from optic chiasma to mammillary bodies.
3. There are neural connections between the hypothalamus and the posterior lobe through hypothalamo hypophyseal tract.
4. There are vascular connection between hypothalamus and the anterior lobe of pituitary.
5. Arterial blood enters pituitary by way of superior hypophyseal artery and inferior hypophyseal artery.
6. The superior hypophyseal artery forms capillary loops at the median eminence and pars nervosa.
7. From these capillaries, blood flows into the hypothalamo hypophyseal portal system, which begins and ends in capillaries without going through the heart.

Hypothalamus….continued

8. Part of the venous out flow from the anterior pituitary is by way of a retrograde back flow, which exposes hypothalamus to high concentrations of anterior pituitary hormones. This blood flow provides the pituitary gland the negative feed- back mechanism of regulating the functions of hypothalamus. This type of feed-back has been termed the short-loop feedback.

9. Hypothalamus in female has got two type of GnRH releasing nuclei viz. 1. Tonic release of LH and FSH regulating nuclei and 2. Pre-ovulatory release of LH and FSH regulating nuclei, these two types of nuclei regulates two types of release of LH and FSH from anterior pituitary.
10. The two type of LH and FSH release in female animals denotes to pulsatile tonic release of LH and FSH or in simpler words the LH and FSH are secreted from anterior pituitary in pulses / not continuously for example one pulse every 4 hours, while pre-ovulatory LH and FSH release is a huge release of these hormones whereby pulses of LH and FSH are overlapping. Pre-ovulatory LH and FSH release occurs only when pre-ovulatory nuclei of hypothalamus are stimulated. These nuclei are stimulated by rising estradiol concentration in blood from mature ovarian follicles.
11. Pre-ovulatory surge releasing nuclei of hypothalamus are not found in male animals.

HYPOPHYSIS OR PITUITARY

The pituitary gland is located in the sella turcica, a bony depression at the base of the brain.

The gland is subdivided into anterior (Adeno-hypophysis) and posterior pituitary (Neuro-hypophysis).

The cell types in the anterior pituitary have traditionally been classified on their staining characteristics into a-granular Chromophobes and granular Chromophils. The chromophils are further divided into acidophils and basophils.

- The classification has been revised with the advent of immunochemistry and electron microscopy.
- Now the anterior pitutitary ceels have been classified into five different cell types secreting six hormones.
- By cell types:
- Somatotropes secretes Growth Hormone (GH) or Somatotrophin (STH),
- Corticotropes secretes Adreno cortico tropic hormone (ACTH),
- Mammotropes secretes Prolactin (PRL),
- Thyrotropes secretes thyroid stimulating hormone,
- Gonadotropes secretes Follicle Stimulating Hormone (FSH) and Leutinizing Hormone (LH).

GONADS

In both sexes the gonads play a dual role:

The production of germ cells (Gametogenesis)

The secretion of gonadal hormones.

- The interstitial cells that are located among the seminiferous tubules are named the Cells of Leydig. The Leydig cells secrete testosterone in the male.
- Theca interna cells of the graafian follicle are the primary source of circulating estrogens.
- Following rupture of the follicle (Ovulation), the granulosa and theca cells are replaced with the corpus luteum that secretes progesterone

PINEAL GLAND

The pineal gland (epiphysis) originates as a neuroepithelial evagination from the roof of the third ventricle under the posterior end of the Corpus callosum.

The pineal gland of the amphibian is a photoreceptor that sends information to the brain, whereas the mammalian pineal is an endocrine gland.

- The hormonal activity of the pineal gland is influenced by both the dark-light cycle and the seasonal cycle, causing it to play an important role in the neuro-endocrine control of reproduction.
- The gland converts neural information from the eyes about day light length into an endocrine output of melatonin, which is secreted into the blood stream and cerebro-spinal fluid

Define Hormone

Which other organs than endocrine glands produce hormones not fulfilling classic definition of a hormone.

- Hormone is a physiologic, organic, chemical substance synthesized and secreted by a ductless endocrine gland which passes into the circulatory system for transport. It inhibit, stimulate or regulate the functional activity of target organ or tissue.
- However, organs like the uterus and the hypothalamus produce hormones, which do not meet classic definition of a hormone.

Growth factors

What are those substances which are related with hormones?

- Role of growth factors is also important.
- Growth factors are hormone related substances controlling the growth and development of several organs, tissues and cultured cells.
- Unlike hormones, growth factors are produced and secreted by cells from different tissues to diffuse into target cells.

LIST OF PRIMARY HORMONES OF REPRODUCTION

From Hypothalamus: GnRH or LHRH, Prolactin Inhibiting Factor, Oxytocin, Vasopressin.

From Adenohypophysis: Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH), Prolactin (PRL).

From Neurohypophysis: Oxytocin, Vasopressin

- From Pineal: Melatonin
- From Ovaries:Estrogen, Progesterone,Relaxin, Inhibin, Activin, Follistatin
- From Testis: Testosterone, Inhibin, Activin, Follistatin
- From Placenta: Human Chorionic Gonadotropin (hCG), Equine Chorinic Gonadotropin (eCG), Placental Lactogen, Protein B
- From Uterus: Prostaglandin F 2 alpha

Questions:

6. What are the circulatory relations between hypothalamus and pituitary?

5. What does it produce?

6. Where does it act?

7. What 2 type of nuclei are found in hypothalamus of a female animal?

8. Which type of these two nuclei are not found in male?

9. Why they are not found in males?

10. What is the stimulus for surge release of LH and FSH?

1. What are the names of organ structures, chemicals and other systems which control reproduction?
2. What are the two systems which initiates, co ordinates or regulate functions of reproductive system?
3. What is the product of endocrine system called?
4. What is Hypothalamus?
5. What are the relations between hypothalamus and pituitary?
6. Where is pituitary gland located?
7. What are the two lobes of pituitary called?
8. What is the old classification for pituitary cells of Anterior Lobe?
9. What is the new classification for pituitary cells of anterior lobe?
10. What is posterior lobe of pituitary?
11. Posterior lobe of pituitary is secretory tissue or storage site for Oxytocin and Vasopressin.
12. Where from Oxytocin is then synthesized ?
13. What are the two important functions of gonads?
14. What are the cells called secreting hormones in the testis?
15. Which hormone does it secrete?
16. What are the cells called secreting hormone from graafian follicle of the ovary?
17. What hormone does it sectertes?
18. What are the cells called secreting hormone from corpus luteum?
19. What hormone does it secretes?
20. Make a list of primary hormones of reproduction along-with the their source of origin