Lecture title: Gonads

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Summary: Gonads

Sex hormones

Sex hormones, also known as gonadal steroids, are steroid hormones that act mainly on androgen or estrogen receptors. Sex hormones are produced by testis and ovaries, and by adrenal gland. Commonly, sex hormones can be divided into three main classes;

1. Androgens (**male hormones**)
2. Estrogens (**female hormones**)
3. Progestogens (**progestational hormones**)

Androgens

It is steroid hormone stimulates and control the development and maintenance of male characteristics in animals by binding to androgen receptors. Small amount of testosterone produced in adrenal cortex, but the majority is made in testis.

Biosynthesis: Androgens are produced in testes (Leydig cells), adrenalcortex, ovary and placenta.

Main Biochemical Functions of androgens (testosterone)

In fetus

1. Development of male internal and external genitalia.

2. Growth of the body.

In adults

1. Support, cooperatively with FSH, the process of spermatogenesis.

2. Stimulate growth and development of male genitalia and sexglands.
3. Regulate secondary sex characteristics.

4. Androgens have anabolic action that increase synthesis and diminish degradation of protein.

5. Androgens cause moderate retention of Na^+, K^+, H_2O, Ca^{2+}, SO_4^-, and PO_4.
6. They are responsible for certain behavioral effects as aggressionand competitiveness.

Estrogens

The principal estrogenic hormone in circulation and the most active form of the estrogen is β-estradiol.

Main Biochemical Functions of estrogens

1. Stimulate final maturation of the follicles.

2. Promote growth and proliferation of endometrial cells.

3. Induce LH surge resulting in ovulation.
4. In the liver, stimulate plasma protein synthesis.
5. Changes lipid profiles by stimulating HDL formation, and decreasing LDL level.
6. Influence release of other hormones as prolactin and thyrotropin.
7. Promote female secondary sex characteristics.
8. Accelerate metabolism, particularly by increasing fat store.

Estrogen synthesis

In the ovary estrogens are produced by the maturing Graffian follicles, both thecal cells and granulosa cells are involved, and also in Corpus luteum. The pituitary gonadotropins—FSH, and LH are involved in the stimulation of estrogen secretion.

Estrogens are also formed in the adrenal cortex, placenta and testes in small amounts.

Progesterone

Progesterone is the hormone of the corpus luteum, the structure which develops in the ovary from the ruptured graafian follicle. It is also formed by the placenta, which secretes progesterone, during the later part of pregnancy. Progesterone is also formed in the adrenal cortex,and the testes.

Biochemical Functions of progesterone

1. The main target organs of progesterone are uterus, mammary gland, and the brain.

2. Progesterone responsible for progestational changes in the endometrium and cyclic changes in the cervix and vagina.

3. Progesterone has anti-estrogenic effects on the myometrial cells, also it is reduce the number of estrogen receptors in the endometrium.

4. On the mammary gland, progesterone enhances the development of lobules and alveoli, in addition it is support secretory function of mammary gland during lactation. While during pregnancy, progesterone inhibit lactation.

5. Large doses of progesterone (especially during pregnancy) inhibit LH secretion and potentiate the inhibitory actions of estrogens preventing ovulation.

Hormones of placenta

The implanted blastocyst forms the trophoblast which is subsequently organized into the placenta. The placenta provides the nutritional connection between the embryo and the maternal circulation.
Progesterone (mentioned above).

Estrogens (mentioned above).

Chorionic gonadotropin

- In human called human chorionic gonadotropin (hCG), in mare (PMSG), it is a glycoprotein composed of 237 amino acids .

- This hormone interact with it is specific receptor at theovary and promote the maintenance of the corpus luteum during the early stage of pregnancy resulting in induction of progesterone secretion from corpus luteum through the first trimester of pregnancy.

- The hormone that is frequently use (with progesterone) in livestock to induce ovulation prior to artificial insemination.

- Pregnant mare produce PMSG between 40-130 days of pregnancy, and once collected, it can be used to induce estrus in cow, ewe, doe, and sow.

Placental lactogen (PL)

- It is a polypeptide placental hormone parallel in structure and action to the growth hormone.

- PL modifies metabolic state of mother during pregnancy to facilitate the energy supply to the fetus.

- This hormone (PLI and PLII) has different action on the mammary gland as lactogenesis, stimulation of mammary cells proliferation, as well as luteal maintenance and progesterone production.