MELATONIN

1. Melatonin (N-acetyl-5-methoxytryptamine) is synthesized in the pineal gland.
2. Pineal parenchymal cells take up the amino acid, tryptophan, from the circulation and convert it to serotonin.
3. Two steps in the metabolism of serotonin are under neural control.
4. The first is the conversion of serotonin to N-acetyl serotonin, which is followed by the conversion N-acetyl serotonin to melatonin.
5. The second step involves the melatonin-forming enzyme, hydroxyindole-o-methyl transferase.

- The synthesis and secretion of melatonin is greatly elevated during darkness.
- Long daily period of elevated secretion of melatonin are probably responsible for the induction of ovarian cycles in ewes and the inhibition of cyclicity in mares.
- Species differences exist in the effects of exogenous melatonin on the gonads and on the timing of treatment.
- Exogenous melatonin regulates ovine gonadal activity.
- Continuous melatonin administration effectively induces breeding activity in acyclic ewes around mid summer.

GONADAL STEROID HORMONES

1. The ovaries and testes primarily secret e gonadal steroid hormones.
2. Non gonadal organs such as adrenals and the placenta also secrete steroid hormones to some extent.
3. They are of four types: Andorgens, Estrogens, Progestins and Relaxin.
4. The first three of the above are steroids while the fourth is a protein.
5. The ovaries produce two steroid hormone, estradiol and progesterone, and a protein hormone relaxin.
6. The testis secretes a single hormone testosterone.
7. Steroid hormones secreted by the ovary, testes, placenta and adrenal cortex have a basic or common nucleus called the cyclopentano per hydro phenanthrene nucleus.
8. It consists of three, six member fully hydrogenated (per hydro) phenanthrene rings designated A, B and C and one five-member cyclopentane ring designated D.
9. An 18-carbon steroid has estrogen activity.
10. A 19-carbon steroid has androgen activity.

GONADAL STEROID HORMONES...continues

11. And a 21-Carbon steroid has progestagen properties.

12. Cholesterol, a 27-carbon steroid, becomes pregnenolone (20-Carbon) when its side chain is cleaved.

13. Pregnenolone is subsequently converted to progesterone, which is in turn converted to an androgen and on to estrogens.

14. The biosynthetic pathways in all endocrine organs that produce steroid hormones are similar, the organs differing only in the enzyme systems they contain.

15. The testis primarily synthesizes androgens.

16. The ovaries synthesize two major types of steroids 18 C- Estrogens and 21-C carbon Progestins.

17. In blood plasma, steroid hormone is mostly bound to albumin, a plasma protein with low affinity and high capacity for steroids.

18. Another portion of the steroid hormone is bound to one or more specific proteins with high affinity.

19. The half life of naturally occurring steroids in the body is very short.

20. Therefore, several steroids with modified biochemical structure have been synthesized for clinical use.

21. The secretory activity of steroid hormones by the gonads is under endocrine control of the anterior pituitary.

Estrogen

Estradiol is the primary estrogen, with esterone and estriol representing other metabolically active estrogens.

Several substances of estrogenic activity are found in both the animal and plant kingdom.

Estradiol is the biologically active estrogen produced by the ovary with smaller quantities of estrone.

Except for the possible secretion of small amounts of estriol in the luteal phase of the cycle, most estriol and related urinary estrogens are metabolic breakdown products of secreted estradiol/estrone.

- All ovarian estrogens are produced from androgenic precursors.
- Plant estrogens (isoflavones) are found primarily in legumes such as subterranean clover and alfalfa.
- Two of these compounds, geneistein and coumestrol cause infertility in females and less frequently, in males.
- Zeronal (Ralgro) is a compound with estrogenic activity produced by a mold.
- As an ear implant, it promotes growth of feedlot animals.
- These compounds act like estrogens but do not have the 18-Carbon steroid nucleus.

Estrogen

Binding proteins in the circulation carry estrogens.

Of all steroids, estrogens have the widest range of physiologic functions. Some of these functions are:

Act on the CNS to induce behavioural estrus in the female, however, small amounts of progesterone with estrogen are needed to induce estrus in some species such as the ewe and cow.

Act on the uterus to increase both amplitude and frequency of contractions by potentiating the effects of oxytocin and PGF 2 alpha.

Physical development of female secondary sexual characteristics.

Stimulate duct growth and cause development of the mammary gland.

- Exert both negative and positive feedback controls on LH and FSH release through the hypothalamus. The negative feed-back is on the tonic centre in the hypothalamus and the positive effect is on the pre-ovulatory centre.
- In ruminants, estrogens also have a protein anabolic effect to increase body weight gains and growth. The possible mechanism for increased growth may be due to the ability of estrogens to stimulate the pituitary to release more growth hormone.
- Diethylstilbiesterol (DES), a synthetic non steroidal estrogens was formerly used for growth promotion in cattle and sheep. DES binds to estrogen receptor, and acts with the same potency as 17 B-estradiol. Because of its carcinogenic effects, it has been replaced by other estrogenic implants.
- Estrogens have been used to abort cows and sheep because of their luteolytic properties (regression of CL) whereas in the sow, estrogens have a luteotrophic action (helps to maintain CL).