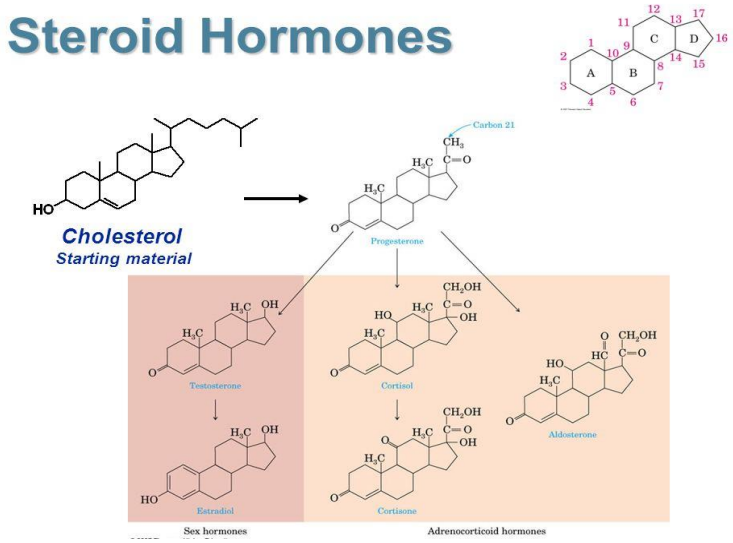
Lecture 11

Steroids

Steroid hormones

Steroid hormone**,** any of a group of hormones that belong to the class of chemical compounds known as steroids; they are secreted by three “steroid glands”—the adrenal cortex, testes, and ovaries—and during pregnancy by the placenta. All steroid hormones are derived from cholesterol. They are transported through the bloodstream to the cells of various target organs where they carry out the regulation of a wide range of physiological functions.

These hormones often are classified according to the organs that synthesize them: the adrenal steroids are so called because they are secreted by the adrenal cortex, and the sex hormones are those produced by the ovaries and testes.



Types of steroid hormones

Glucocorticoids

Glucocorticoids are a class of steroid hormone that regulate carbohydrate metabolism. Cortisol is the major representative in most mammals.

Mineralocorticoids

Mineralocorticoids are a class of steroid hormone that regulates the body levels of sodium and potassium.

Androgens

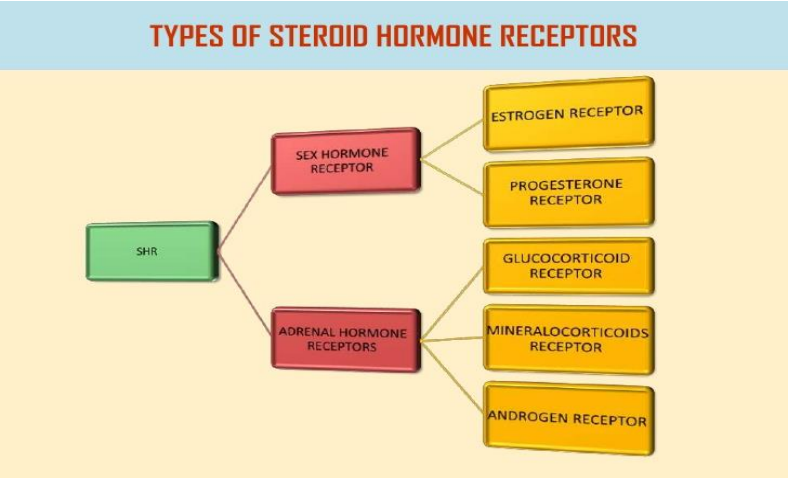
Androgens are a class of steroid hormone produced by the adrenal cortex whose actions are similar to that of steroids produced by the male gonads.

Estrogens

Estrogen is the primary female sex hormone and is responsible for development and regulation of the female reproductive system and secondary sex characteristics. Estrogen may also refer to any substance, natural or synthetic, that mimics the effects of the natural hormone

Progestogens

Progestogens are a class of steroid hormones that bind to and activate the progesterone receptor (PR). The most important progestogen in the body is progesterone (P4).



Origin of Steroid Hormones

Steroid Hormones are not packaged, but synthesized and immediately released. These hormones are all derived from the same parent compound known as cholesterol. Enzymes synthesizing them from cholesterol are located in mitochondria and smooth ER. Steroids are lipid soluble and thus are freely permeable to membranes. So they are not stored in cells.

Properties of Steroid hormones

1) Steroid hormone is not water soluble.
2) So have to be carried in the blood complexed to specific binding globulins.
3) Corticosteroid binding globulin carries cortisol.
4) Sex steroid binding globulin carries testosterone and estradiol.
5) Sometimes, a steroid is secreted by one cell and converted to its active form by the target cell.
6) An example is androgen which secreted by the gonad and converted into estrogen in the brain.

Steroid hormone synthesis

The natural steroid hormones are generally synthesized from cholesterol in the gonads and adrenal glands. These forms of hormones are lipids. They can pass through the cell membrane as they are fat-soluble, and then bind to steroid hormone receptors (which may be nuclear or cytosolic depending on the steroid hormone) to bring about changes within the cell. Steroid hormones are generally carried in the blood, bound to specific carrier proteins such as sex hormone-binding globulin or corticosteroid-binding globulin.

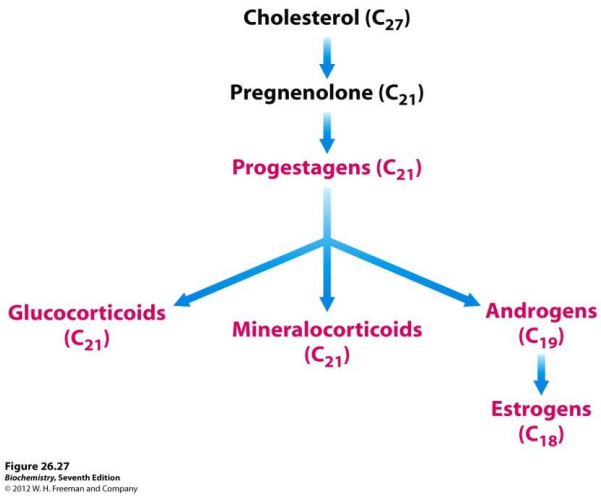


Figure 26.27
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Fatty Acid Derivatives Eicosanoids

Eicosanoids are a large group of molecules derived from polyunsaturated fatty acids.
The principal groups of hormones of this class are

1) Prostaglandins
2) Prostacyclins
3) Leukotrienes
4) Thromboxanes

Regulation of Hormone Secretion

The rate of hormone biosynthesis and secretion is often regulated by a negative feedback control mechanism. Such a mechanism depends on factors that influence the metabolism and exertion of hormones. Thus, higher hormone concentration alone cannot trigger the negative feedback mechanism. Negative feedback must be triggered by overproduction of an "effect" of the hormone.

Hormone secretion can be stimulated and inhibited by:

- Other hormones (stimulating- or releasing -hormones)
- Plasma concentrations of ions or nutrients, as well as binding globulins

- Neuron and mental activity
- Environmental changes, e.g., of light or temperature

Control of Endocrine Activity

1) Rate of production

Synthesis and secretion of hormones are the most highly regulated aspect of endocrine control.

2) Rate of delivery

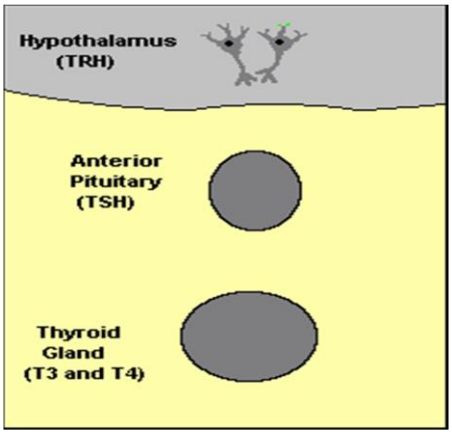
An example of this effect is blood flow to a target organ or group of target cells - high blood flow delivers more hormone than low blood flow

3) Rate of degradation and elimination

Hormones, like all biomolecules, have characteristic rates of decay, and are metabolized and excreted from the body through several routes.

Feedback Control of Hormone Production

Feedback loops are used extensively to regulate secretion of hormones in the hypothalamic-pituitary axis. An important example of a negative feedback loop is seen in control of thyroid hormone secretion.



Negative Feedback

• When blood concentrations of thyroid hormones increase above a certain threshold.
• TRH-secreting neurons in the hypothalamus are inhibited and stop secreting TRH.
• This is an example of "negative feedback".

References:

https://en.wikipedia.org/wiki/Steroid_hormone
http://www.britannica.com/science/steroid-hormone
https://en.wikipedia.org/wiki/Hormone#Regulation
https://www.coursehero.com/file/p1plha1/Control-of-Endocrine-Activity-Rate-of-production-Synthesis-and-secretion-of/