Steroid hormones

Steroid hormones are hormones of a lipophilic nature that arise from cholesterol through the process of steroidogenesis. They are not stored, but their synthesis increases when needed. They are transported in the blood mostly bound to plasma proteins , a small part of steroid hormones is in the plasma in free (unbound) form. In the target tissue, it acts via intracellular receptors.

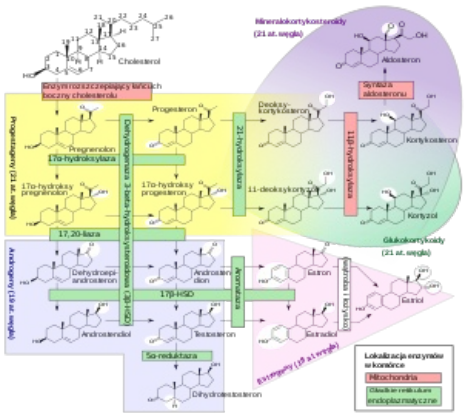
Steroid hormones include:

- Glucocorticoids (cortisol);
- Mineralocorticoids (aldosterone);
- Androgens (testosterone);
- Estrogens;
- Progesterone;
- Calcitriol;

Synthesis of steroid hormones

The site of synthesis is the endocrine cells of the adrenal cortex , the Leydig cells of the testes, the follicular cells of the ovaries , the placenta and the corpus luteum . The basic step is the shortening of the side chain of cholesterol by 6 carbons and the formation of pregnenolone , which is catalyzed by the mitochondrial enzyme desmolase (= cytochrome-P-450-side chain cleaving enzyme, P450 SCC). All steroid hormones are subsequently synthesized from pregnenolone.

See Steroid Hormone Synthesis for more detailed information .



Synthesis of steroid hormones

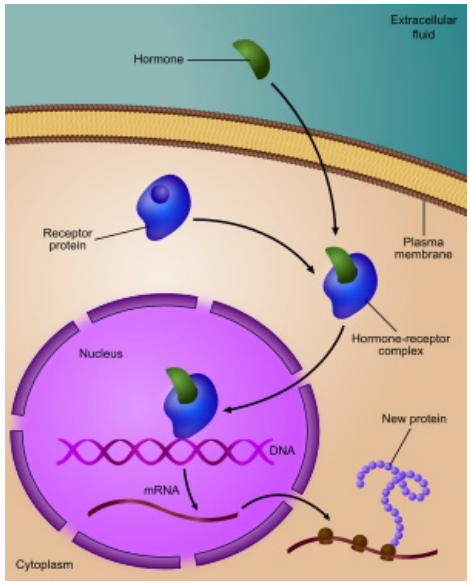
Steroid hormone receptors

They are proteins located in the cytosol of the cell **(intracellular receptors) to which heat shock proteins** (hsp) bind in an inactive state . From a functional point of view, they are **transcription factors** that are activated by a ligand (steroid hormone). They contain several domains:

1. **Ligand binding domain** (LBD) – serves to bind the hormone;
2. **Dimerization domain** (DD) – enables dimerization of the receptor after its activation by a ligand;
3. **Nuclear localization signal** (NLS) – directs the activated receptor to the cell nucleus;
4. **DNA-binding domain** (DBD) – enables binding of the receptor to the steroid responsive element (SRE – sequence-specific section of DNA) in the region of the DNA major groove ;
5. **Transactivation domain** (TAD) – enables transactivation (activation of various proteins of the transcription apparatus).

Steroid hormone signalling

Steroid hormones are lipophilic and are therefore transported in the blood bound to transport proteins (e.g. SHBG = sex hormone-binding globulin). A small part of steroid hormones is bound to albumins. Only 1-2% of the total concentration of steroid hormones is found free in the blood. This free fraction penetrates through the cytoplasmic membrane into the target cells and in the cytosol binds to the ligand binding domain of the receptor. This will activate the receptor and disconnect the heat shock protein. Dissociation of the hsp allows dimerization of the two receptors (via their dimerization domains) and exposure of the nuclear localization signal, leading to translocation of the receptor to the nucleus. The dimerized receptor in the nucleus occupies the steroid responsive element located in the promoter regions of genes regulated by steroid hormones. Steroid hormones subsequently **influence** gene expression (in the sense of activation or repression). They usually influence gene expression through coactivators (or corepressors), which, unlike steroid hormones, interact with and influence the transcription apparatus complex.



A simplified scheme of steroid hormone regulation of gene expression

Links

Related articles:

- Cholesterol
- Steroidogenesis

Reference

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2. SILBERNAGL, Stefan and Agamemnon DESPOPOULOS. *Atlas of Human Physiology.* 6th edition. Prague: Grada, 0000. 0 pp. ISBN 80-247-0630-X .
3. MATOUŠ, Bohuslav, et al. *Fundamentals of medical chemistry and biochemistry.* 1st edition. Prague: Galén, 2010. 540 pp. ISBN 978-80-7262-702-8

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