Sex hormones/Expert

Sex hormones (estrogen and progesterone in women and testosterone in men) play an important role in the development and maintenance of sex differences. They regulate the activity of many autosomal genes in a way which is sex-specific. Sex hormones can pass through the cell membrane and bind to special hormone receptors. Hormone-laden receptors then attach themselves to specific structures in regulatory DNA elements and can thus inhibit or promote the reading of a gene (and thus the production of a protein). In this way, certain proteins are produced in different quantities depending on the sex. [1]Kindler-Röhrborn A, Pfleiderer B. Gendermedizin - Modewort oder Notwendigkeit?: - Die Rolle des Geschlechts in der Medizin. XX 2012; 1(03):146–52.</ref>

Estrogen

In addition to functions such as the promotion of bone metabolism, the development of the secondary female sex organs, the stimulation of libido and the initiation of follicular maturation, the female sex hormone estrogen also has a decisive influence on brain processes. Estrogen can be produced not only in the ovaries, but (like testosterone) also in neurons and astrocytes of the brain (especially in places with a high concentration of estrogen receptors). Estrogen receptors are found in women mainly in frontal regions.

Estrogens can influence the release of neurotransmitters such as serotonin thereby affecting pain perception and depressive symptoms. [1]</ref> The menstrual cycle can have a strong modulating effect on some brain functions: For example, high estrogen levels occur in the follicle and luteal phases and can strongly affect pain perception.

The female estrogen level has a positive influence on e.g. immune function, oxidative stress response and antioxidant status, lipoprotein metabolism, fat storage and stress response via the HPA axis (hypothalamus-pituitary-adrenal cortex axis). A combination of these factors provides a determinant for the higher life expectancy of women (compared to men). [2] If postmenopausal estrogen levels fall significantly, health conditions such as loss of bone density, cognitive impairment or depressive symptoms can often occur. [3]

Testosterone

Testosterone level differs considerably in concentration in men and women and mechanism of action varies between the sexes as well. In addition to the main functions such as growth, muscle mass development and sperm production, testosterone also has a crucial impact on the brain. Testosterone is produced not only in the testicles, but (like estrogen) also in neurons and astrocytes of the brain (especially at sites with high concentrations of testosterone receptors). [4] Testosterone binds to androgen receptors especially in areas such as the hypothalamus, thalamus, hippocampus and in the deep layers of the cerebral cortex (e.g. in the medial temporal lobe). These regions play a vital role in learning processes and memory formation.

The significance of testosterone becomes particularly clear when a deficiency is present.

Testosterone levels decrease in older men, but even younger men can experience deficiencies due to testicular, metabolic and/or disturbances of the central regulatory systems. The sexual and catabolic effects of androgen deficiency in hypogonadism are well researched: libido and potency decrease, muscle and bone mass are reduced, anemia and depression can occur, and cognitive impairments arise. Testosterone effects on mood and cognition are also conditioned by the genetically determined CAG-repeat polymorphism of the androgen receptor gene. Testosterone can have significantly different effects on a person despite similar inter-individual concentrations. The relationship between testosterone and depression is also well documented. Results suggest that certain subgroups of depressive men suffer from hypogonadism and can thus benefit from testosterone replacement. For example, late-onset depression in men is among other things dependent on the CAG-repeat polymorphism of the androgen receptor gene. [1]</ref>

Literature

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1. **Cite error: Invalid <ref> tag; no text was provided for refs named "Kindler-Röhrborn"**
2. Seifarth JE, McGowan CL, Milne KJ. Sex and life expectancy. Gender medicine 2012; 9(6):390–401.
3. Jaspers L, Daan NMP, van Dijk GM, Gazibara T, Muka T, Wen K et al. Health in middle-aged and elderly women: A conceptual framework for healthy menopause. Maturitas 2015; 81(1):93–8.
4. Iivonen S, Heikkinen T, Puoliväli J, Helisalmi S, Hiltunen M, Soininen H et al. Effects of estradiol on spatial learning, hippocampal cytochrome P450 19, and estrogen alpha and beta mRNA levels in ovariectomized female mice. Neuroscience 2006; 137(4):1143–52.

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