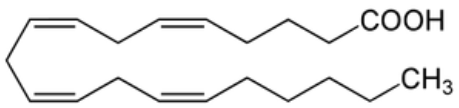
Prostaglandins

The name **prostaglandin** is derived from the prostate gland , as prostaglandins were once thought to be its product (in fact, they are produced by seminal vesicle cells). It belongs to the so-called **autacoids** (Greek *autos* - self, *akos* - medicine), i.e. local hormones. They act paracrine (on surrounding cells), have a short biological half-life. Together with prostacyclins , thromboxanes and leukotrienes , they belong to eicosanoids - derivatives of essential polyunsaturated fatty acids, e.g. arachidonic acid(5,8,11,14-eicosatetraene). It is part of the phospholipids of the plasma membrane of cells. With the help of phospholipase A 2 , it is released from it and is thus available for the synthesis of many substances used in a number of physiological and pathological events.

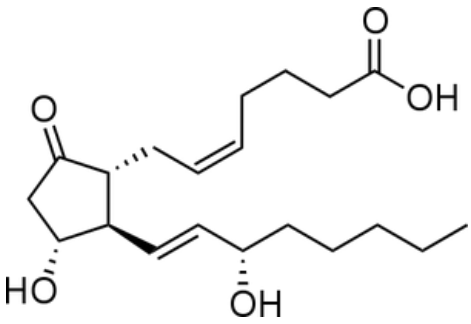
Synthesis

The key enzyme for the synthesis of prostanoids (prostaglandins, prostacyclins and thromboxanes) is **cyclooxygenase** , which is present in all tissues of the human body. It has three isoforms:

- COX-1, which is constitutive (still active),
- COX-2, which is inducible, its activity increases mainly during inflammation - their formation is induced by pro-inflammatory cytokines ; but it was found that in some organs (stomach , brain) this isoform is also constitutionally active,
- and finally COX-3, which is derived from the COX-1 gene.

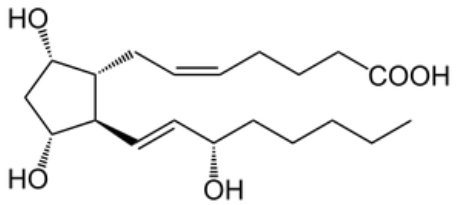


Arachidonic acid formula



Prostaglandin E 2 formula

The synthesis of prostanoids by cyclooxygenase takes place in two steps, the first is the formation of the unstable endoperoxide PGG 2 from arachidonic acid, the second step is the formation of PGH 2 , from which the other prostanoids are formed by the action of other tissue-specific enzymes. The activity of cyclooxygenase, specifically the first step, is inhibited by non-steroidal anti-inflammatory drugs − some of them inhibit COX-1 and COX-2 non-specifically (**e.g. acetylsalicylic acid** , although it prefers COX-1 in small quantities), others prefer COX-2 (**meloxicam**, **nimesulide**) , there are also selective COX-2 inhibitors − **coxibs**, which were expected to have lower side effects, but the hopes were not fully fulfilled, as their use leads to a higher incidence of cardiovascular diseases (myocardial infarction). Corticosteroids reduce the expression of the COX-2 gene , which, together with other effects, is the basis of their strong immunosuppressive action.



Prostaglandin F 2α formula

Effects

The effects of prostaglandins are mediated through G-proteins , both through the adenylate cyclase pathway (formation of cAMP), but also through phospholipase C (IP 3 and DG). Prostaglandins E cause vasodilation, causing a decrease in systemic blood pressure, but at the same time increase flow through the heart, kidneys and mesenteric area. They are cytoprotectants of the gastric mucosa, they reduce the secretion of HCl by the parietal cells and at the same time increase the formation of HCO 3 - . PGE 2 is important for maintaining blood flow through the kidneys , it increases diuresis . They have a uterotonic effect - they support uterine contractions . They are important mediators of inflammation (they are responsible for inflammatory pain by sensitizing receptorspains), are also used in the development of bronchial asthma .

Pharmacological uses

- **Alprostadil** (PGE 1) is used in ischemic disease of the lower limbs and in some erectile disorders,
- **Latanoprost** (an analogue of PGF 2α) is used in the treatment of glaucoma − it increases the outflow of ventricular fluid (it does not affect its own production),
- **Dinoprostone** (PGE 2) and **Dinoprost** (PGF 2α) cause contractions of the myometrium, are used to induce or support childbirth , in combination with **Mifepristone** (antagonist of progesterone receptors) induce abortion .

Links

Related Articles

- Eicosanoids
- Prostaglandin E1
- Prostaglandin E2

References

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- NEČAS, Emanuel, et al. *Pathological physiology of organ systems: 2nd volume.* 2nd edition. Prague: Nakladatelství Karolinum, 2009. ISBN 978-80-246-1712-1 .
- - *Latanoprost* [online]. [feeling. 2011-02-24]. < https://en.wikipedia.org/wiki/Latanoprost >.
- - *Prostaglandin* [online]. [feeling. 2011-02-24]. < https://en.wikipedia.org/wiki/Prostaglandin >.