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PROSTAGLANDINS IN THE BODY AND IN PREPARATIONS

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Abstract: Prostaglandins (Pg) are a group of lipid physiologically active substances formed in the body enzymatically from some essential fatty acids and containing a 20-membered carbon chain. Prostaglandins are mediators with pronounced physiological effects. They are derivatives of prostanic acid. Prostaglandins, together with thromboxanes and prostacyclin, form a subclass of prostanoids, which in turn are included in the class of eicosanoids.

Key words: prostaglandin, lipid, enzyme, mediator, cyclooxygenase, histamine, bradykinin, macrophage.

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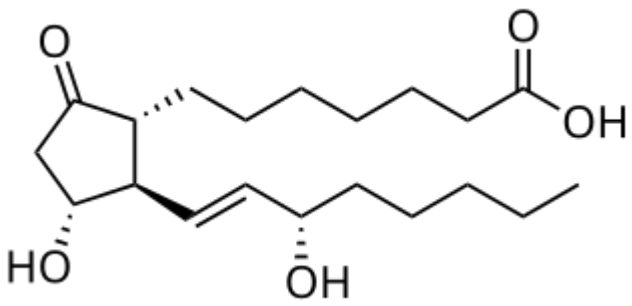

Prostaglandin was first isolated in 1935 by the Swedish physiologist Ulf von Euler from seminal fluid, so the term “prostaglandin” comes from the Latin name for the prostate gland (lat. glandula prostatica)[2]. Later it turned out that prostaglandins are synthesized in many tissues and organs. In 1971, John Wayne discovered that aspirin is an inhibitor of prostaglandin synthesis. For his research on prostaglandins, he and Swedish biochemists Sune Bergström and Bengt Samuelsson received the 1982 Nobel Prize in Physiology or Medicine [3].

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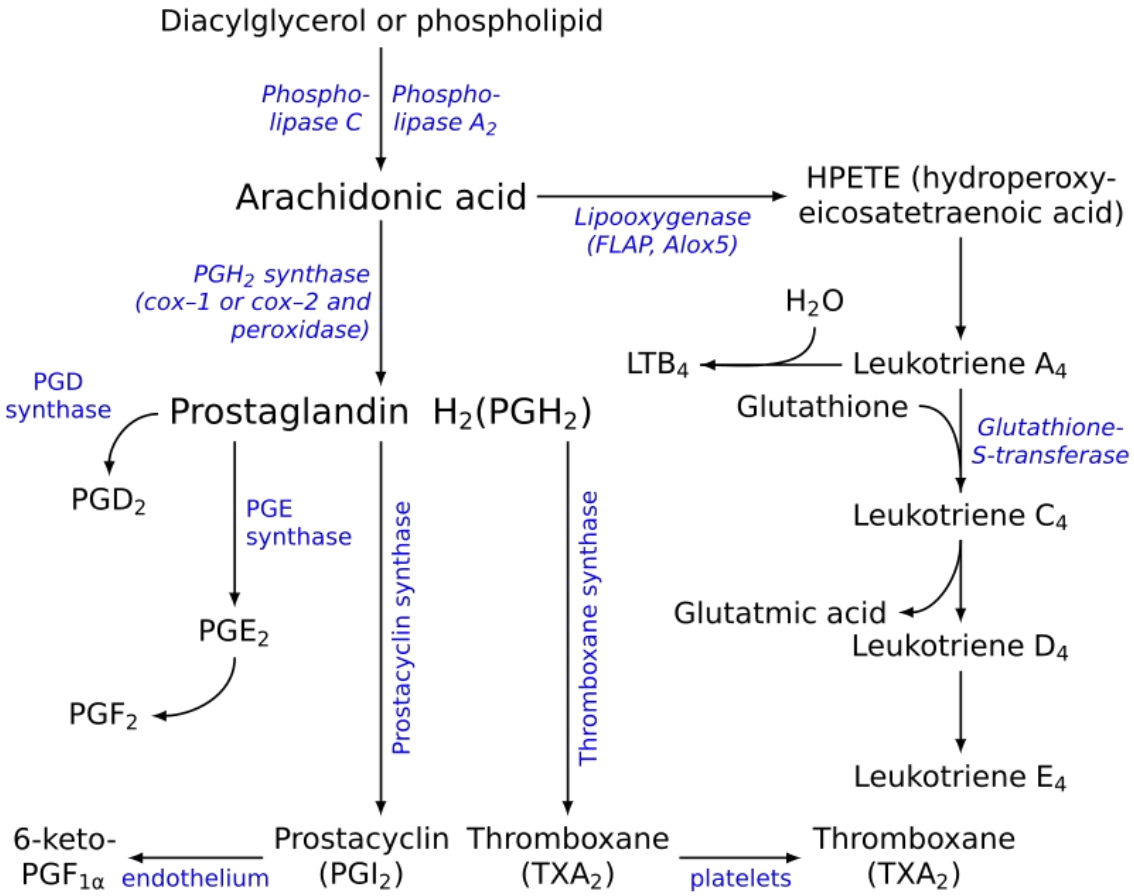
Prostaglandins are found in almost all tissues and organs. They are autocrine and paracrine lipid mediators that act on platelets, endothelium, uterus, mast cells and other cells and organs. Prostaglandins are synthesized from essential fatty acids (EFAs)[4].

Fatty acid	**NLC type**	Type
Gamma-linolenic acid (GLA) via DGLA	ω-6	Type 1
Arachidonic acid (AA)	ω-6	Type 2
Eicosapentaenoic acid (EPA)	ω-3	Type 3

The intermediate is formed by the action of phospholipase A2, which is then converted by either the cyclooxygenase or lipoxygenase pathway. The cyclooxygenase pathway synthesizes thromboxanes, prostacyclin and prostaglandins D, E and F. The lipoxygenase pathway, which is active in leukocytes and macrophages, produces leukotrienes.



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The synthesis of prostaglandins occurs in two stages: oxidation under the action of cycloxygenase and the final prostaglandin synthase. There are two types of cyclooxygenases: COX-1 and COX-2. It is believed that COX-1 determines the basal level of prostaglandins, and COX-2 triggers the synthesis of prostaglandins when stimulated (for example, during inflammation).

Prostaglandin E synthase

Prostaglandin E2 (PGE2) is formed by prostaglandin E synthase from prostaglandin H2 (PGH2). Several prostaglandin E synthases have been discovered. Microsomal prostaglandin E synthase-1 is thought to be a key form of the enzyme that synthesizes PGE2.

Prostaglandins in the body

When biologists first discovered prostaglandins in seminal fluid, they decided that these substances were synthesized in the prostate. This story later gave rise to the modern name.

This group of physiologically active lipids is characterized by the presence of 20 carbon atoms in the molecule, including the carbon ring. Prostaglandins are found in almost all animal and human tissues. The main difference between substances and hormones is that they are synthesized not in specific organs, but throughout the body.

Features of PG functioning

This class of hormone-like compounds still attracts the attention of researchers in the field of biochemistry due to its unique properties. It has been noted that the same substance from this group can have different or even opposite effects in different organs.

The ability of prostaglandin to enhance a certain type of biological reaction in one tissue and inhibit it in another is determined solely by the type of receptor to which the active substance molecule binds. There are 9 types of PG receptors located throughout the body.

Prostacyclin

This prostaglandin is actively synthesized by the endothelium, the inner lining of blood vessels. Another place where prostacyclin is produced is the lungs. It is known as a vasodilator because it exerts a vasodilatory effect by influencing specific IP receptors on arterial smooth muscle cells.

Increased prostacyclin production occurs during oxygen deprivation, vascular damage, due to the activity of inflammatory mediators and adrenaline. The substance has a pronounced antiplatelet effect, as it prevents the formation of a blood clot in the vessel.

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With intravenous administration of prostacyclin, blood pressure in the systemic and pulmonary circulation decreases. The main use of analogues of the substance is the treatment of pulmonary hypertension. Synthetic prostacyclin preparations:

Name of the drug	Method of administration
Enoprostenol	Intravenous administration
Treprostinil	Intravenous subcutaneous administration
Beraprost	Orally
Iloprost	Intravenous, oral, inhalation

Prostaglandin E2 (PGE2)

Like prostacyclin, PGE2 has a vasodilatory effect. It plays an important role in normal kidney function because it reduces the absorption of sodium and chloride ions and reduces the effect of the hormone vasopressin. In addition, PGE2 performs a number of functions:

Bronchoconstriction (bronchial obstruction).

Bronchodilation (enlargement of the bronchi).

Relaxation and contraction of the smooth muscles of the gastrointestinal tract.

Decreased secretion of hydrochloric acid in the stomach.

Increased production of gastric mucus.

Contraction of the muscular layer of the uterus.

Inhibition of lipolysis (the process of breaking down fats into fatty acids).

Release of thermal energy (pyrogenic effect).

Participation in the formation of a blood clot.

A synthetic analogue of prostaglandin E2 (Dinoprostone) is indicated to stimulate cervical ripening and induce labor. This is due to the fact that it has an effect on all organs that contain smooth muscle muscles, including the tone and contractile activity of the muscular layer of the uterus. In addition to stimulating muscle cells, Dinoprostone increases blood supply to the cervix, thereby accelerating its ripening. One of the indications for the use of the drug is medical abortion.

Dinoprostone exists in the form of tablets, infusion solution, solution for intravenous and extra-amniotic administration, and vaginal gel. This drug is used only under the supervision of a physician. If dosages are not observed, the following side effects are possible:

Convulsive contractions of the uterus.

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Nausea, vomiting, headache.

Redness of the skin.

Increased body temperature.

Fetal heart rhythm disturbances.

Fetal asphyxia.

In hospital use under medical supervision, none of these side effects will be observed.

There are analogues of Dinoprostone under the names Cerviprost, Enzaprost-E, Medullin, Prepidil and others.

Prostaglandin F2α

Another representative of the prostaglandin group. The key functions of PGF2α are bronchoconstriction, uterine contraction, and the initiation of destruction of the corpus luteum in the ovary (luteolysis). As a result of luteolysis, the synthesis of the steroid progesterone stops. The release of prostaglandin F2a is regulated by the level of oxytocin (a neurohormone synthesized by the pituitary gland).

Prostaglandins, due to their diversity and unique properties, have become reliable assistants in medicine. Their use gives good results with minimal risks.

Further studies of this group of physiologically active compounds will open up new possibilities for their use in the treatment of human diseases.

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