Beta-2 Receptor

The beta-2 adrenergic receptor is a G protein-coupled receptor coupled to the Gs protein. This protein activates adenylate cyclase, which catalyzes the formation of cAMP, which, in turn, activates protein kinase A. Cardiopulmonary effects of beta-2 activation include increased heart rate and contractility as well as bronchodilation. Metabolic effects of B2 receptor activation include increased lipolysis, increased insulin secretion, increased glycogenolysis, and increased cellular potassium uptake.In the eye, beta-2 receptor activation results in increased aqueous humor production. Therefore, beta-2 agonists are contraindicated in glaucoma. Actions also include smooth muscle relaxation in the uterus, which can reduce uterine irritability and prevent or stop preterm labor, as well as vasodilation in the muscle and liver to aid in the fight-or-flight response.

PLAY PICMONIC

Characteristics

Gs Protein Class

G-spot

The beta-2 adrenergic receptor is a G-protein-coupled receptor coupled to the Gs protein. This protein activates adenylate cyclase, which catalyzes the formation of cAMP, which, in turn, activates protein kinase A.

Cardiopulmonary

Increased Heart Rate

Up-arrow HR Heart-timer

Actions of the beta-2 receptor include increased heart rate in the sinoatrial node, known as a chronotropic effect. This effect leads to increased cardiac output in the sympathetic response, although the effect is minor when compared to the beta-1 receptor.

Increased Contractility

Up-arrow Heart flexing

Actions of the beta-2 receptor include increased atrial and ventricular contractility, known as an inotropic effect. This effect leads to increased cardiac output in the sympathetic response, although the effect is minor when compared to the beta-1 receptor.

Bronchodilation

Broccoli-dyed Lungs

Activation of beta-2 receptors leads to smooth muscle relaxation in the bronchi, resulting in bronchodilation. Therefore, beta-2 agonists can be used in the treatment of asthma.

Metabolic

Increased Lipolysis

Up-arrow Lip-lights

Lipolysis is the breakdown of lipids, which involves the hydrolysis of triglycerides into free fatty acids, which can undergo degradation by beta-oxidation to produce energy for the body. Activation of this receptor can lead to increased lipolysis to help mobilize energy stores during the sympathetic response.

Increased Insulin

Up-arrow Insect-syringe

Activation of this specific receptor leads to an increase in insulin secretion from the pancreas. However, in the overall sympathetic response, this effect is minor compared to the insulin-decreasing effects of the alpha-2 receptor. Therefore, there is an overall decrease in insulin secretion in the sympathetic response.

Increased Glycogenolysis

Up-arrow Glider-lights

Stimulation of beta-2 receptors can also enhance glycogenolysis in the liver. Glycogenolysis is the process that breaks down glycogen into glucose-1-phosphate and glucose molecules.

Increased Cellular Potassium Uptake

Up-arrow Cellular-phone Banana Uptake-tube

Activation of the beta-2 receptor leads to an intracellular shift of potassium. This is through increased action of the Na/K ATPase. This shift generally lasts for 4-6 hours and can be used as a temporizing measure for patients with hyperkalemia.

Considerations

Increased Aqueous Humor Production

Up-arrow Water from Eye-fountain

In the eye, beta-2 receptor activation leads to an increase in production of aqueous humor in the eye. Therefore, beta-2 stimulation is highly contraindicated in glaucoma, and beta-2 antagonists, such as timolol, may be used.

Vasodilation

Vase-dyed

While alpha-1 receptors mediate vasoconstriction, beta-2 receptors mediate vasodilation in the muscle and liver to aid in the fight or flight response.

Decrease Uterine Tone

Down-arrow Relaxed Uterus

Actions of the beta-2 receptor include smooth muscle relaxation in the uterus, which can be used to reduce uterine irritability and prevent or stop preterm labor. These medicines are commonly called tocolytics. An example of a Beta-2 agonist used as a tocolytic is ritodrine.