Beta-2 Receptor

The beta 2 adrenergic receptor is a G protein coupled receptor that is coupled to the Gs protein, which activates adenylate cyclase, which catalyzes the formation of cAMP which activates protein kinase A. Actions of this receptor include increased heart rate and contractility as well as increased lipolysis and insulin release. In the eye, activation of this receptor results in increased aqueous humor production as well as ciliary muscle relaxation, which overall leads to increased intraocular pressure. Therefore, beta 2 agonists are contraindicated in glaucoma. Actions also include smooth muscle relaxation in the uterus, which can be used to reduce uterine irritability and prevent or stop preterm labor, as well as smooth muscle relaxation in the bronchi, resulting in bronchodilation. Additionally, while alpha 1 receptors mediate vasoconstriction, beta 2 receptors mediate 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 that is coupled to the Gs protein, which activates adenylate cyclase, which catalyzes the formation of cAMP, which activates protein kinase A.

Increased Heart Rate

Up-arrow HR Heart-timer

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

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 as 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 Aqueous Humor Production

Up-arrow Water from Eye-fountain

In the eye, activation of this receptor 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.

Ciliary Muscle Relaxation

Seal Muscle Relaxing

The ciliary muscle is a ring of smooth muscle in the eye that controls accommodation for viewing objects and regulates the flow of aqueous humor into Schlemm's canal. Sympathetic activation of beta-2 receptors result in relaxation and increase in ciliary body size. This increases tension of the zonule fibers of the eye, causing the lens to stretch flat, appropriate for far distance vision. Relaxation of the ciliary muscle also impedes aqueous flow, leading to an increase in intraocular pressure.

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.

Bronchodilation

Broccoli-dyed Lungs

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

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.