An inverse agonist is a type of ligand that binds to the same receptor as an agonist (a molecule that activates the receptor) but produces an opposite pharmacological effect. In other words, while agonists activate the receptor and promote a cellular response, inverse agonists inhibit the constitutive or basal activity of the receptor.

To better understand this concept, it's essential to know about constitutive receptor activity. Many receptors in the human body have a certain level of basal or constitutive activity, even in the absence of any specific ligand (agonist or antagonist). Inverse agonists work by reducing this constitutive activity of the receptor, resulting in an overall decrease in the signaling pathway activity associated with that receptor.

Here's a summary of the actions of different ligands on a receptor:

Agonist: Binds to the receptor and activates it, resulting in an increase in the receptor's signaling pathway activity.

Inverse Agonist: Binds to the receptor and reduces or inhibits its constitutive activity, leading to a decrease in the receptor's signaling pathway activity below the basal level.

Antagonist: Binds to the receptor but does not activate or inhibit its constitutive activity. Instead, it blocks the binding of agonists, preventing their activation of the receptor. Antagonists do not cause a cellular response but can effectively "turn off" the receptor.

It's important to note that not all receptors exhibit constitutive activity, so inverse agonists are only relevant for receptors that do have this basal level of activity. Additionally, inverse agonists can have different effects depending on the specific receptor and the signaling pathway it activates or inhibits.

Inverse agonists can have therapeutic implications, especially in cases where reducing the constitutive activity of a receptor is desirable for treating certain medical conditions. However, not all receptors have inverse agonists identified or used as therapeutic agents. The study of inverse agonists and their effects on receptors is an active area of research in pharmacology and drug development.

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