

Non-Competitive Inhibition

Non-competitive inhibition is a type of inhibition that reduces the effectiveness of enzymes at catalyzing reactions. It is a subset of reversible inhibition, which means that the enzyme is not permanently altered in any way. The substrate does not compete with the inhibitor for binding to the active site, which means the substrate is often free to bind to the active site. The inhibitor binds to a separate site known as the allosteric site, and it has a strong enzyme-inhibitor complex because it is not competing with the substrate for binding. K_m remains constant because this inhibition does not affect substrate binding, and adding more substrate will not affect the reaction kinetics. Regardless of how much additional substrate is added, the enzyme will still be less effective. This is because the enzyme has a different conformational form, called a conformational shift. In this form it is less effective at converting substrate to product in the active site. Because it is less effective, it has a lower V_{max} . The inhibited reaction has a lower maximum rate because of the ineffectiveness of the enzyme.



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Characteristics

Reversible Inhibition

Cars driving in Reverse

Non-competitive inhibition is a type of reversible inhibition because the enzyme is not permanently altered. In this type of inhibition, product formation is prevented for a limited time.

Substrate Freely Binds The Active Site

Sub Holding Action-clapperboard

The substrate can freely bind the active site in non-competitive inhibition. This is because the inhibitor is not attempting to bind the active site for the substrate that normally binds the enzyme.

Inhibitor Strongly Binds Allosteric Site

Inhibit-officer Strongly-grabbing Aloe-plant

The inhibitor binds a separate site known as the allosteric site, and changes the ability of the enzyme to catalyze transformation of the substrate to the product. This enzyme-inhibitor complex is strong because it is not competing with the substrate for binding.

K_m Constant

Same-size K_m

In non-competitive inhibition, K_m is constant (concentration of substrate at one-half V_{max}) because adding more substrate will not affect the reaction kinetics. The binding of the substrate is not affected.

Enzyme Has Different Conformational Form

Enzyme Low-rider-car

Though the enzyme is not permanently altered, it does change conformation while the inhibitor is bound, preventing the enzyme from catalyzing the transformation from substrate to product.

Low V_{max}

Low V_{max} speed limit sign

Though K_m remains unchanged, non-competitive inhibition results in a lower V_{max} , which is a lower maximum rate of reaction. This is because the enzyme is less able to convert the substrate into product at the active site and can no longer function as well as an uninhibited enzyme.