Mini Review

Annals of Clinical and Laboratory Research
ISSN 2386-5180

2023
Vol.11 No.2:456

Breaking Down Barriers: The Power of Enzyme Inhibitors in Treating Diseases and Disorders

Edward Flynn*

Department of Biophysics, Federal University of São Paulo, São Paulo, Brazil

Received: 02-Feb-2023, Manuscript No. IPACLR-23-13625; **Editor assigned:** 04-Feb-2023, PreQC No. IPACLR-23-13625 (PQ); **Reviewed:** 18-Feb-2023, QC No. IPACLR-23-13625; **Revised:** 21-Feb-2023, Manuscript No. IPACLR-23-13625 (R); **Published:** 25-Feb-2023, DOI: 10.36648/2386-5180.23.11.456

***Corresponding author:**
Edward Flynn

flynnE@unifesp.br

Department of Biophysics, Federal University of São Paulo, São Paulo, Brazil

Citation: Flynn E (2023) Breaking Down Barriers: The Power of Enzyme Inhibitors in Treating Diseases and Disorders. Ann Clin Lab Res. Vol.11 No.2:456

Introduction

Enzymes are proteins that catalyse biochemical reactions in living organisms. They play critical roles in various metabolic pathways, and their activity must be tightly regulated to maintain homeostasis. Enzyme inhibitors are molecules that can bind to enzymes and interfere with their activity, thereby regulating the rate of the biochemical reaction [1]. Types and mechanisms of enzyme inhibitors, as well as their applications in medicine and industry.

There are two main types of enzyme inhibitors: reversible and irreversible. Reversible inhibitors can bind to and dissociate from the enzyme, while irreversible inhibitors form a covalent bond with the enzyme, permanently inactivating it.

Reversible inhibitors can be further classified into competitive, non-competitive, and uncompetitive inhibitors. Competitive inhibitors bind to the active site of the enzyme, preventing the substrate from binding. Non-competitive inhibitors bind to a site other than the active site, changing the enzyme's conformation and reducing its activity. Uncompetitive inhibitors bind to the enzyme-substrate complex, preventing the release of the product and reducing the overall reaction rate [2].

Irreversible inhibitors, as the name suggests, form a covalent bond with the enzyme, irreversibly inactivating it. They are often used in the development of drugs, as they can provide long-lasting effects.

The mechanisms of enzyme inhibition can vary depending on the type of inhibitor. Competitive inhibitors compete with the substrate for binding to the active site of the enzyme, effectively reducing the concentration of active enzyme available to catalyse the reaction. Non-competitive inhibitors, on the other hand, bind to a site other than the active site, altering the enzyme's conformation and reducing its activity. Uncompetitive inhibitors bind to the enzyme-substrate complex, preventing the release of the product and reducing the overall reaction rate [3].

Reversible inhibition can be further divided into three types: Competitive, Uncompetitive, and Non-competitive inhibition.

Competitive inhibition occurs when a molecule, known as the inhibitor, competes with the substrate for the enzyme's active site. The inhibitor molecule binds to the active site and prevents the substrate from binding, reducing the enzyme's activity. Competitive inhibitors can be overcome by increasing the substrate concentration, which increases the chances of substrate binding to the enzyme's active site.

Uncompetitive inhibition occurs when the inhibitor molecule binds to the enzyme-substrate complex, forming a stable complex and preventing the reaction from proceeding. This type of inhibition is non-competitive with respect to the substrate, as it does not compete for the enzyme's active site. Non-competitive inhibition occurs when the inhibitor molecule binds to a site on the enzyme other than the active site, causing a conformational change in the enzyme that reduces its activity. This type of inhibition is non-competitive with respect to the substrate, as it does not compete for the enzyme's active site [4].

Irreversible inhibition occurs when the inhibitor molecule forms a covalent bond with the enzyme, resulting in permanent loss of activity. This type of inhibition is irreversible, as the enzyme cannot be regenerated once it has been inhibited. Irreversible inhibitors are often used as drugs to target specific enzymes in the treatment of diseases, such as cancer. Enzyme inhibitors have many applications in medicine and industry. In medicine, enzyme inhibitors are used to treat various diseases, such as hypertension, diabetes, and cancer. For example, angiotensin-converting enzyme (ACE) inhibitors are used to treat hypertension by inhibiting the conversion of angiotensin I to angiotensin II. This reduces vasoconstriction and blood pressure. Similarly, protease inhibitors are used to treat HIV by inhibiting the viral protease, which is required for the production of infectious viral particles [5].

In industry, enzyme inhibitors are used in various processes, such as food production and drug development. For example, amylase inhibitors are used to control the production of glucose in the food industry, while protease inhibitors are used to prevent protein degradation during the production of recombinant proteins.

Conclusion

Enzyme inhibition is a crucial process in regulating enzymatic activity and controlling metabolic pathways. The mechanisms of enzyme inhibition can be classified into reversible and irreversible inhibition, with reversible inhibition further classified into competitive, uncompetitive, and non-competitive inhibition. Understanding the mechanisms of enzyme inhibition is important in the development of drugs that target specific enzymes in the treatment of diseases.

References

1. Drawz SM, Bonomo RA (2010) Three Decades of β-lactamase Inhibitors. Clin Microbiol Rev 23:160–201.
2. Wlodawer A, Vondrasek J (1998) Inhibitors of HIV-1 Protease: A Major Success of Structure-assisted Drug Design 1. Annu Rev Biophys Biomol Struct. 27:249–284.
3. Claessen VI, Engelkamp H, Christianen PCM, Maan JC, Rowan AE, et al. (2010) Single-biomolecule kinetics: the art of studying a single enzyme. Annu Rev Anal Chem 3:319-340.
4. Lu HP, Xun L, Xie XS (1998) Single-molecule enzymatic dynamics. Science 282:1877-1882.
5. Edman L, Rigler R (2000) Memory landscapes of single-enzyme molecules. Proc Natl Acad Sci USA 97:8266–8271.