



# Enzymes and Isoenzymes: Therapeutic and Diagnostic Applications

Enzymes are biological catalysts essential for life. Isoenzymes are their tissue-specific variants.

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# Understanding Enzyme Fundamentals

Reaction Speed

Enzymes accelerate reactions up to 10 ^17 times faster.

Specificity

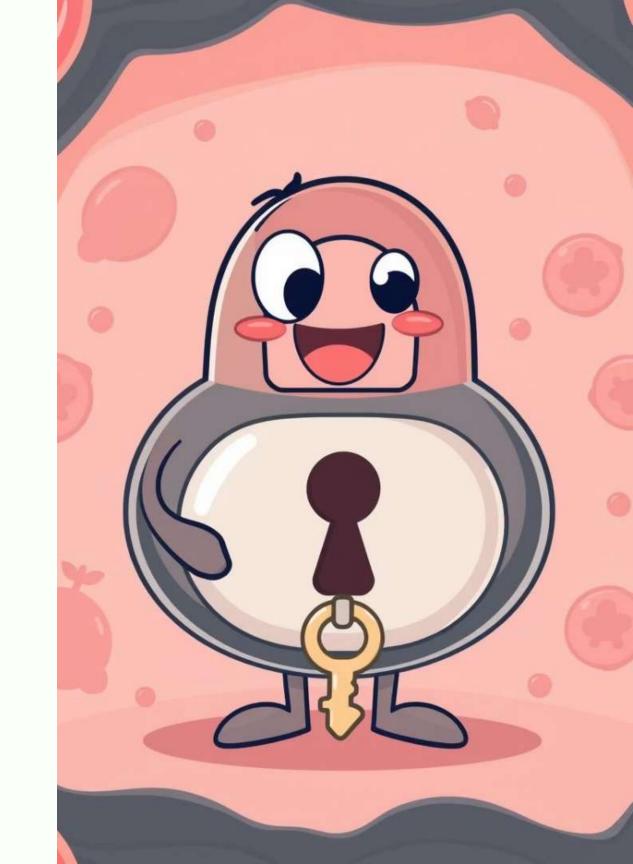
Operate via lock-and-key or induced fit models.

Cofactors

Non-protein helpers like metal ions and vitamins aid function.

Enzyme Kinetics

Michaelis-Menten model describes reaction rates.



# Therapeutic Applications of Enzymes

Replacement Therapy

deficiencies in patients.

Corrects enzyme

Thrombolytic Enzymes

Dissolve blood clots: streptokinase, tPA.

Digestive Aids

Amylase, lipase, protease support digestion.

Anti-inflammatory Enzymes

Serrapeptase reduces inflammation effectively.

Asparaginase acts as an anti-cancer agent by depleting nutrients in leukemia cells.



# Enzyme Replacement Therapies for Genetic Diseases

#### Gaucher Disease

Recombinant glucocerebrosidase (Cerezyme) therapy.

## Pompe Disease

Uses alglucosidase alfa (Myozyme) replacement therapy.

## Fabry Disease

Treatment with agalsidase alfa or beta enzymes.

## Mucopolysaccharidoses (MPS)

Various enzyme replacements target MPS subtypes.

# Enzymes as Diagnostic Markers in Disease

## Tissue Damage

Enzyme release signals damage location and severity.

### Heart Attack

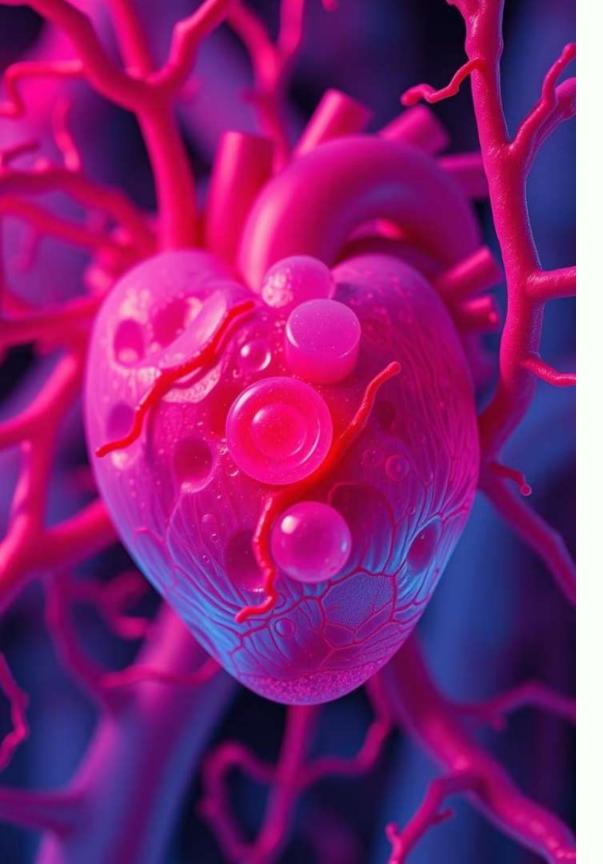
CK-MB and Troponin levels indicate myocardial infarction.

### Liver Health

ALT and AST enzymes reveal liver disease status.

### **Pancreatitis**

Amylase and lipase enzymes diagnose pancreatic inflammation.



# Isoenzymes in Precision Diagnostics

CK-MB Specific to cardiac muscle, key in heart damage detection. Lactate Dehydrogenase (LDH) LDH-1 and LDH-2 patterns confirm myocardial infarction. Alkaline Phosphatase (ALP) ALP-1 and ALP-2 identify liver or bone disorders. Prostate-Specific Antigen (PSA) Different isoforms predict prostate cancer aggressiveness.

# Innovative Enzyme Technologies

1

### **Immobilization**

Improves enzyme stability and reusability in treatments.

2

## **Engineering**

Modifying enzymes for tailored medical and industrial uses.

3

### **Biosensors**

Devices using enzymes to detect specific substances quickly.

4

## Nanoparticles

Enable targeted delivery of enzymes to precise sites.





# Future Trends & Conclusion

### Personalized Medicine

Enzyme therapies tailored to individual genetic profiles.

# Synthetic Enzymes

Artificial enzymes designed for enhanced clinical applications.

## Point-of-Care Tests

Rapid enzyme-based diagnostics for timely care decisions.

## Ongoing Impact

Enzymes and isoenzymes remain vital in therapy and diagnostics.