



# Enzymes

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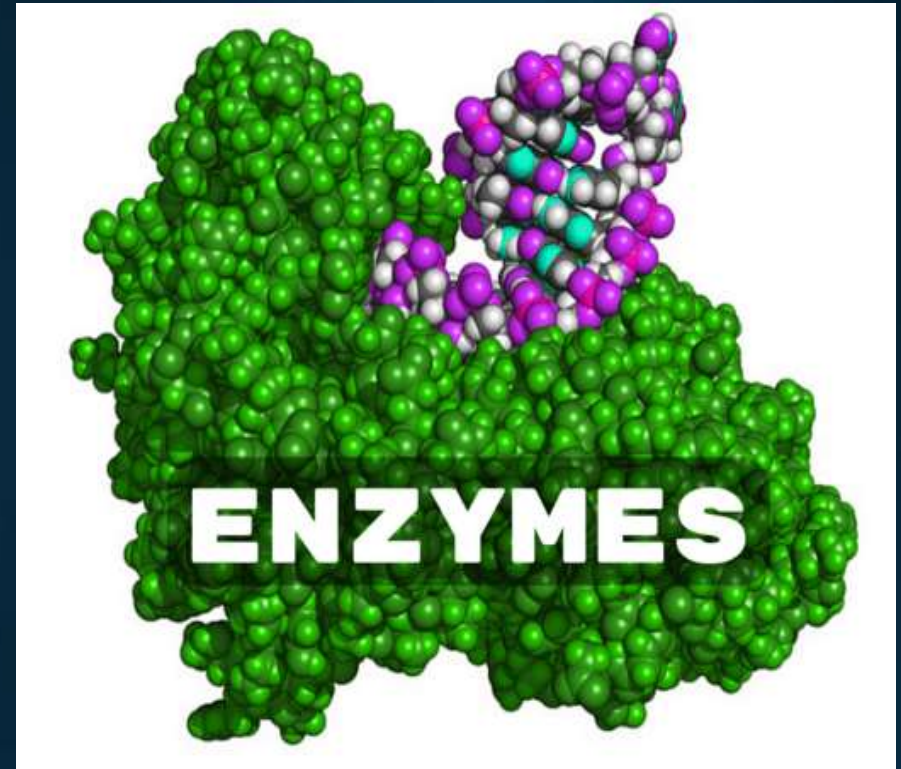



# Outlines

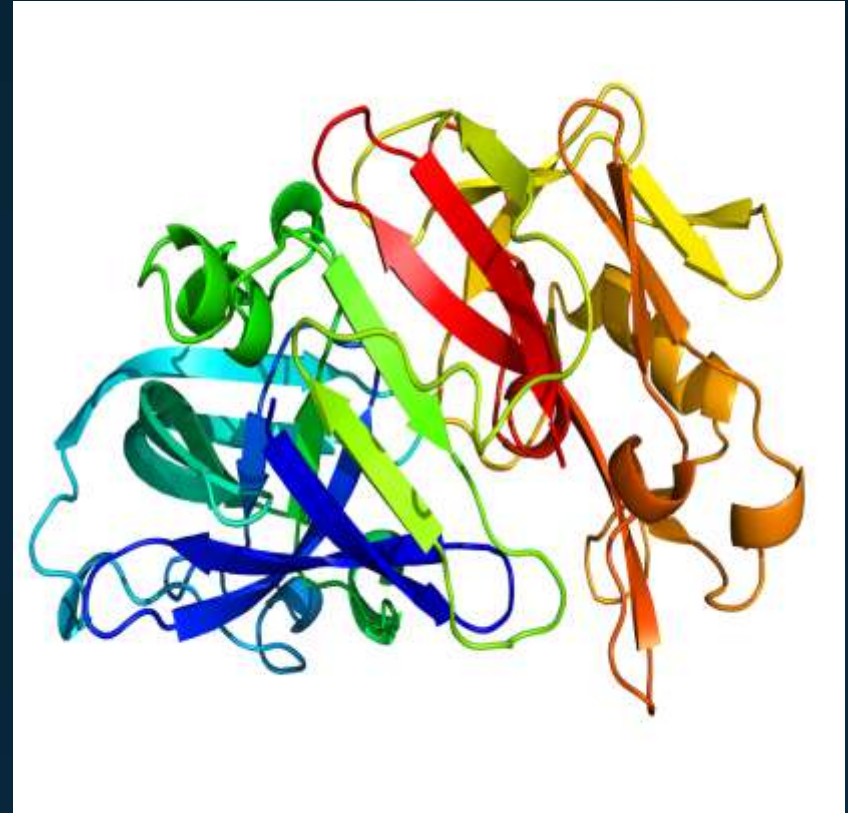
- ❖ What is the features of enzymes?
- ❖ What are the classification?
- ❖ How they works?
- ❖ Examples
- ❖ Functions
- ❖ Proprties
- ❖ Applications
- ❖ References

# What is enzymes?

- ✓ These are biocatalysts.
- ✓ Proteinaceous nature.
- ✓ Macromolecules.
- ✓ Enzymes are “**proteins**”
- ✓ Starting molecules-  
“**substrates**”
- ✓ Named by combining the name of substrate with “**ase**” (suffix)
- ✓ Chemicals are “**activators**”- enhance enzyme activity
- ✓ “**inhibitors**”- decrease enzyme activity



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- ✓ Study of enzymes – **“enzymology”**
  - ✓ These do not affect the nature of final product.
  - ✓ Catalyst enzymes regulate the speed and specificity of reaction.
  - ✓ Enzymes are produced by the living cells only.
  - ✓ Many enzymes initiate the biological reaction.





# Classification of enzymes

- ❖ There are 6 broad categories used to classify enzymes

## ENZYMES

## EXAMPLES

- |                   |                                |
|-------------------|--------------------------------|
| ➤ Oxidoreductases | L&D amino acid oxidases        |
| ➤ Hydrolases      | Pepsin, ureases                |
| ➤ Isomerases      | Phosphohexose isomerase        |
| ➤ Ligases         | Succinate thiokinase           |
| ➤ Lyases          | Fumarase, histidase            |
| ➤ Transferases    | Transaminases, transmethylases |



**oxidoreductases**

Involved in electron transfer

**hydrolases**

Cleave the substrate by hydrolysis

**isomerases**

Transfer a group in a molecule to form an isomer

**Ligases**

Couple the breakdown of a pyrophosphate bond in a nucleotide to the formation of new chemical bonds.

**Lyases**

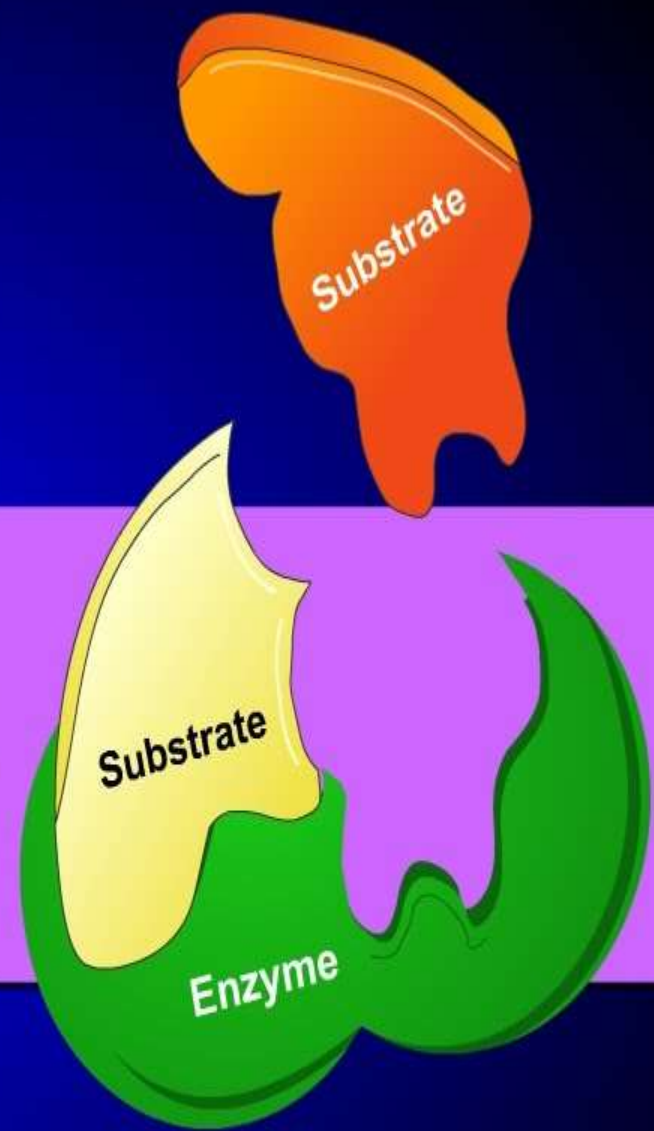
Involved in the addition/removal of water, ammonia, CO<sub>2</sub>, etc.,

**transferases**

Transfer a chemical group from one molecule to another.

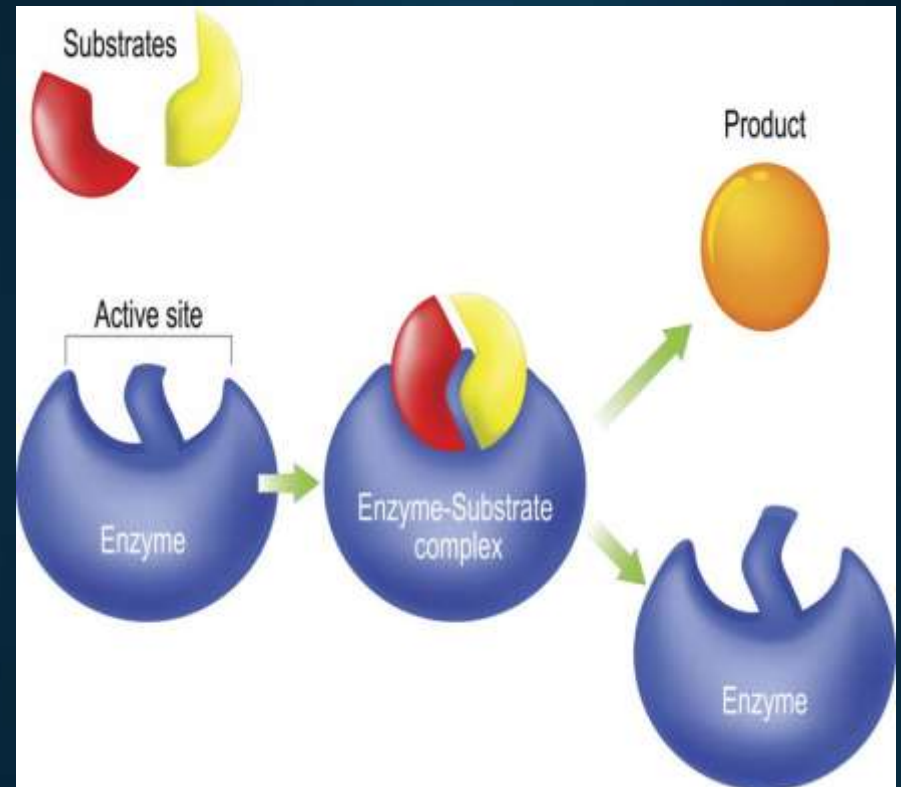


# How Enzymes Work



# How enzymes work?

- ✓ Lock and key model- Emil Fischer in 1894.
- ✓ An enzymes active site is a specific shape & only the substrate will fit into it.
- ✓ It is known as “**lock & key**”.
- ✓ Modification of the lock & key model is called as “**induced fit model**”.
- ✓ Induced fit model – Daniel Koshland in 1958.
- ✓ Once the substrate is fully locked in and in the exact position, the catalysis can begin.



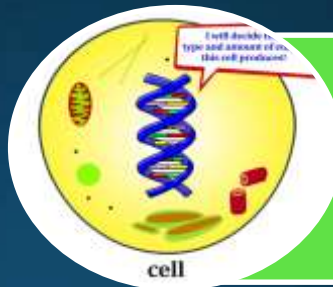


# What do enzymes do?



## Digestive system

To breakdown the larger complex into smaller molecules – glucose



## DNA replication


To help in the cell division/ unwinding the DNA coils & copying the information.



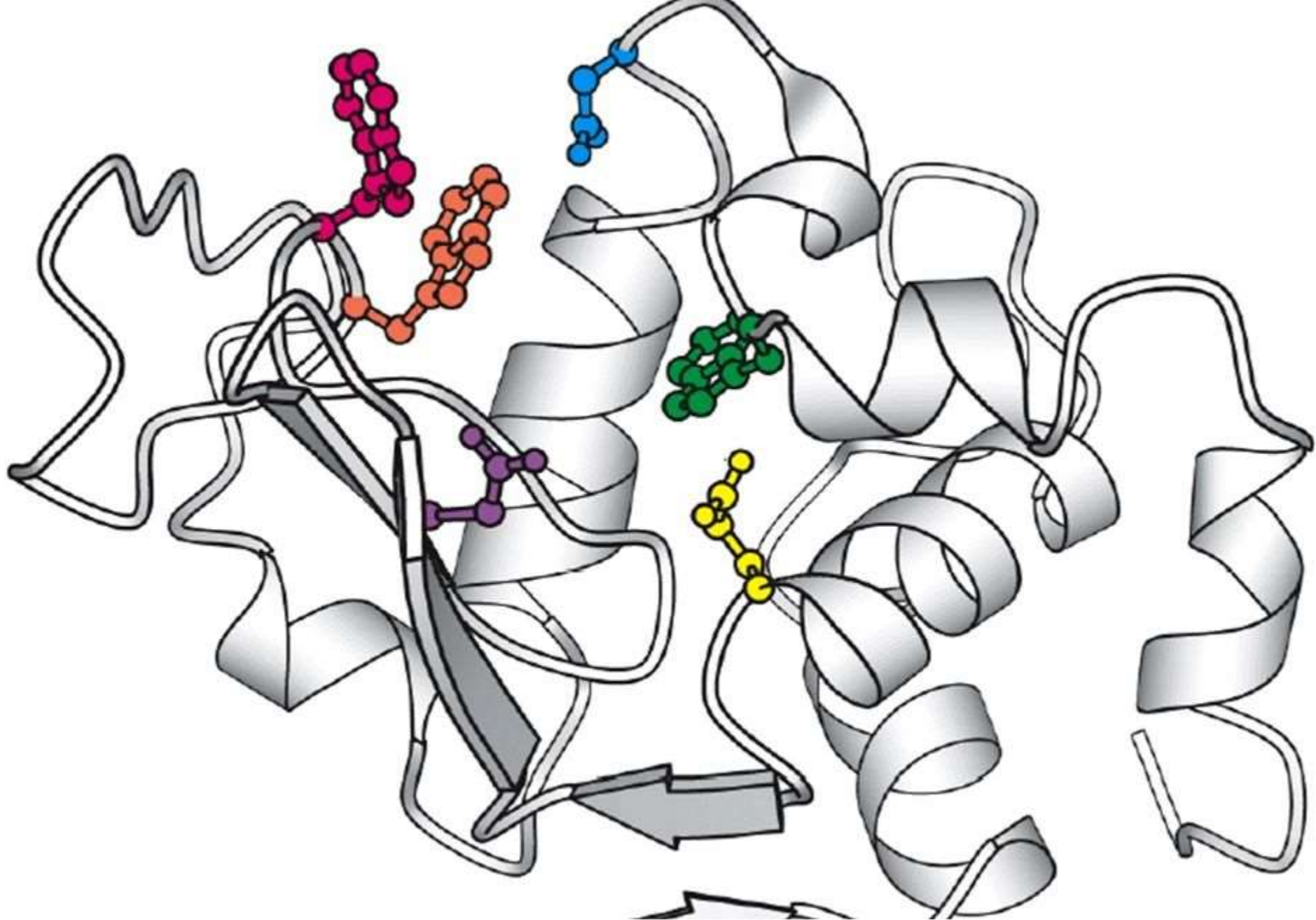
## Liver enzymes

Liver breaks down toxins in the body using the enzymes.

# Examples of specific enzymes



ENZYMES	FUNCTIONS
Lipases	Help digest fats in the gut.
Amylases	Helps change starches into sugars. Found in saliva.
Maltases	Breaks sugar maltose into glucoses. Found in potatoes, pasta, beer & saliva.
Trypsin	Breaks protein down into amino acids. Found in small intestine.
Lactase	Breaks lactose, sugar in milk, into glucose & galactoses. Found in small intestine.
Helicase	Unravels DNA
DNA polymerases	Synthesize DNA from deoxyribonucleotides.



**Structure and physical-chemical properties of enzymes.**



# Physical properties of enzymes

- ✓ Colloidal in nature.
- ✓ High molecular weight.
- ✓ Inactivated at  $60^{\circ}$  C.
- ✓ Thermo labile enzymes are activate at  $100^{\circ}$ - $120^{\circ}$  or even higher.
- ✓ Optimum temperature is  $25^{\circ}$ - $45^{\circ}$  C.
- ✓ Contains carbon, hydrogen, oxygen, nitrogen and small amount of sulphur.



# Cntnu....,

- ✓ Composed of amino acids that are linked together by peptide bonds.
- ✓ Provides structural support for cell.
- ✓ Provides a defense mechanisms against pathogens.
- ✓ Response to chemical stimuli.
- ✓ Secretes hormones.



# Chemical properties of enzymes

## Catalytic properties:

- ✓ Biological catalysts.
- ✓ Small quantity of enzyme catalyses the larger quantities of substances.
- ✓ Enzymes increase the rate of reaction.

## Specificity of enzymes:

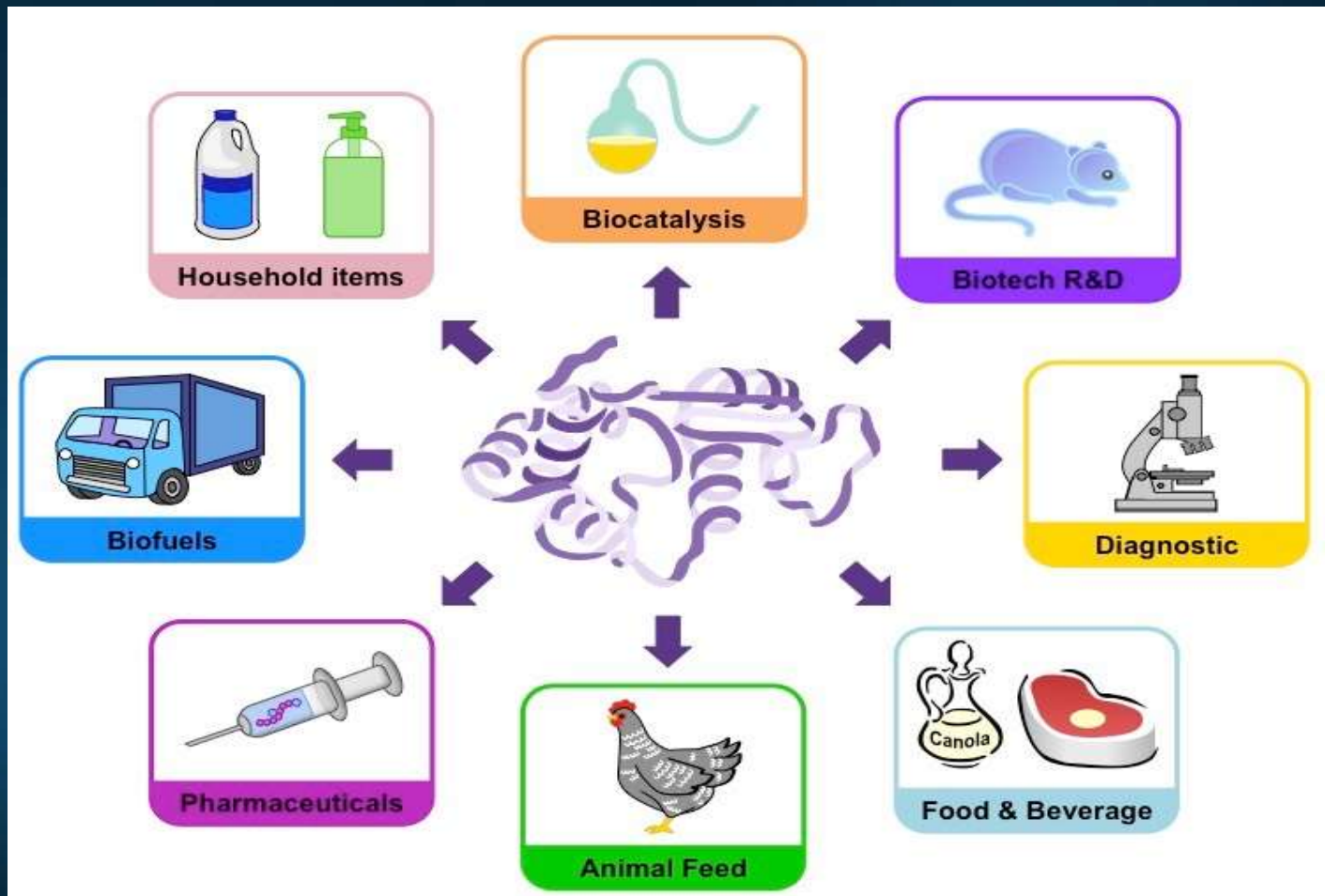
- ✓ Highly specific in nature.
- ✓ Particular enzyme can catalyze particular reaction.
- ✓ Example: sucrase can catalyze only hydrolysis of sucrose.
- ✓ Many enzymes are inactivate when first produced. that is called as "proenzymes or zymogens".



# Cntnu...,

- ✓ They are active to bind with substrate. That is called as “**coenzyme or activator**”.
- ✓ Simple protein enzymes – urease, amylase and papain.
- ✓ Complex protein enzymes – contain conjugated proteins.
- ✓ Protein part called as “**apoenzymes**”.
- ✓ Non protein called as “**prosthetic group**”.
- ✓ Non protein part associated with protein unit is called as “**holoenzyme**”.
- ✓ Less complex than proteins.

# Application of enzymes





# Reference

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Thank you

