Presentation:
Clinical Use of Enzymes

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Clinical use of enzyme

Enzymes

Enzymes are both proteins and biological catalyst (biocatalysts) within living cells.

Catalyst:

Catalyst increase the rate at which chemical reactions occur without being consumed or permanently altered themselves.

Chemical reaction

A process that converts one or more substances(know as reagents, reactants, or substances) to another type of substance(the product)

Structure of enzymes

Like all proteins, enzymes are composed of one or more long chains of interconnected amino acids. Each enzymes possesses a unique sequence of amino acid that cause it to fold into a characteristic shape.

Substrate :

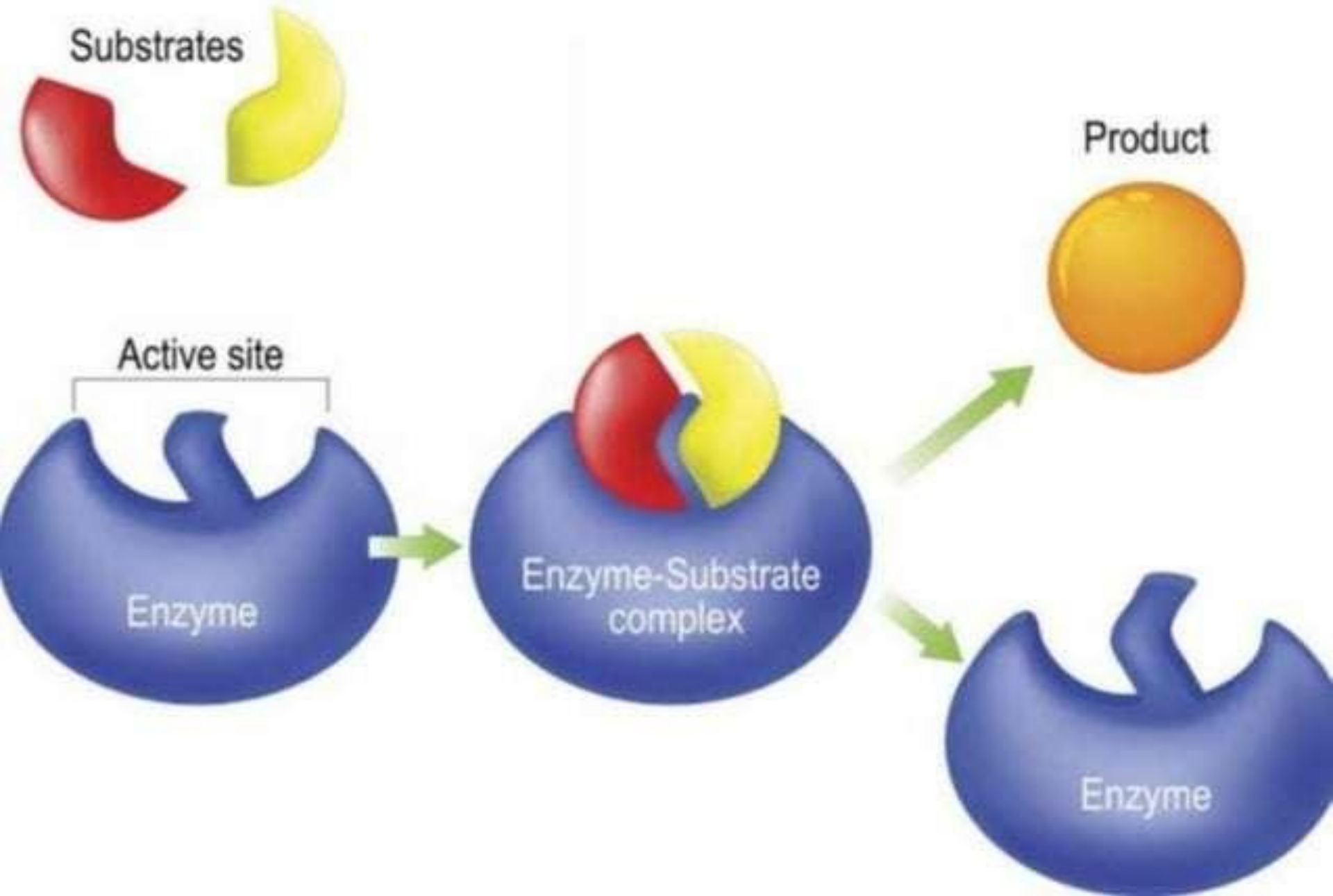
The molecules upon which enzymes may act are called substrates.

Product:

Enzymes convert the substrate into different molecules know as product.

Enzymology:

The scientist who study enzymes are called enzymology.


Substrates
Product
Active site
Enzyme
Enzyme-Substrate complex
Enzyme

CLINICAL USE OF ENZYMES

Introduction:

- Enzymes are proteins which catalyze the biochemical reaction in an animal.
- They are responsible for supporting almost all the chemical reactions that maintain the animal's homeostasis.
- Almost all significant life processes depend on enzymes activity.
- Enzymes enhance the rate of reaction about 106 times more than non-catalysed reactions.

- Enzyme are found in all most all tissues and fluids of the body
- Intra-cellular cellular enzymes catalyze the reaction of metabolic .

Clinical enzymology

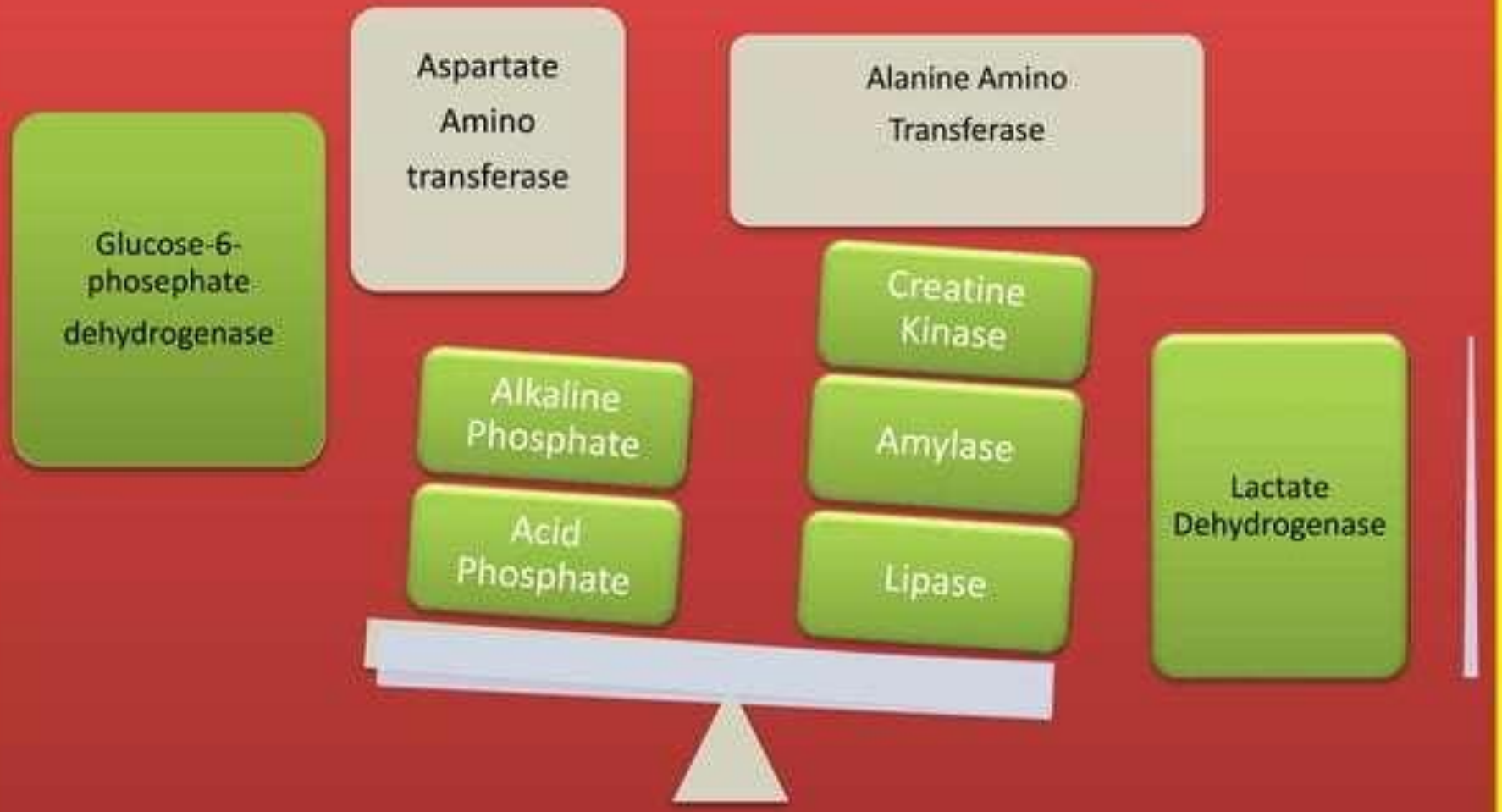
- Clinical Enzymology deals with the application of enzymes analysis for diagnosing and treating disease. It gained importance with the introduction of serum alkaline phosphate (ALP) as a diagnostic aid by King and Armstrong in 1927.

❖ The measurement of serum levels of numerous enzymes in the plasma is used as an indicator of disease of a particular organ.

Enzymes of clinical significance

Enzyme	Source of blood elevation
ALT	hepatopathy
AST	MI, hepatopathy
GMT	hepatopathy (alcohol, drugs)
ALP	Biliary tract diseases, bone diseases
ACP	prostatic cancer
CK	MI (CK-MB), muscle diseases
AMS	pancreatitis
LPS	pancreatitis
CHS	hepatopathy (alcohol, drugs) – decreased

There are nine enzymes a of clinical significance



1-Aspartate amino transferase (AST)

AST catalyses L- aspartame to oxaloacetate and oxo-glutarate to glutamate. The normal level of AST in serum is 0-41 IU/L. AST is widely measured in the investigation of liver disease.

2-Alanine amino transferase (ALT)

ALT catalyses the reversible deamination of alanine to pyruvate. Increased ALT is used as a prognostic indicator of liver damage due the inflammation, hypoxia, toxicants or other factors. The normal serum value of ALT is 0-45 IU/L.

3-Creatine kinase (CK)

CK catalyses the reversible phosphorylation of ATP to form creatine phosphate, required by muscles. Significance is muscular disorder, muscle damages, brain injury, etc. Normal serum value is 10-50 IU/L.

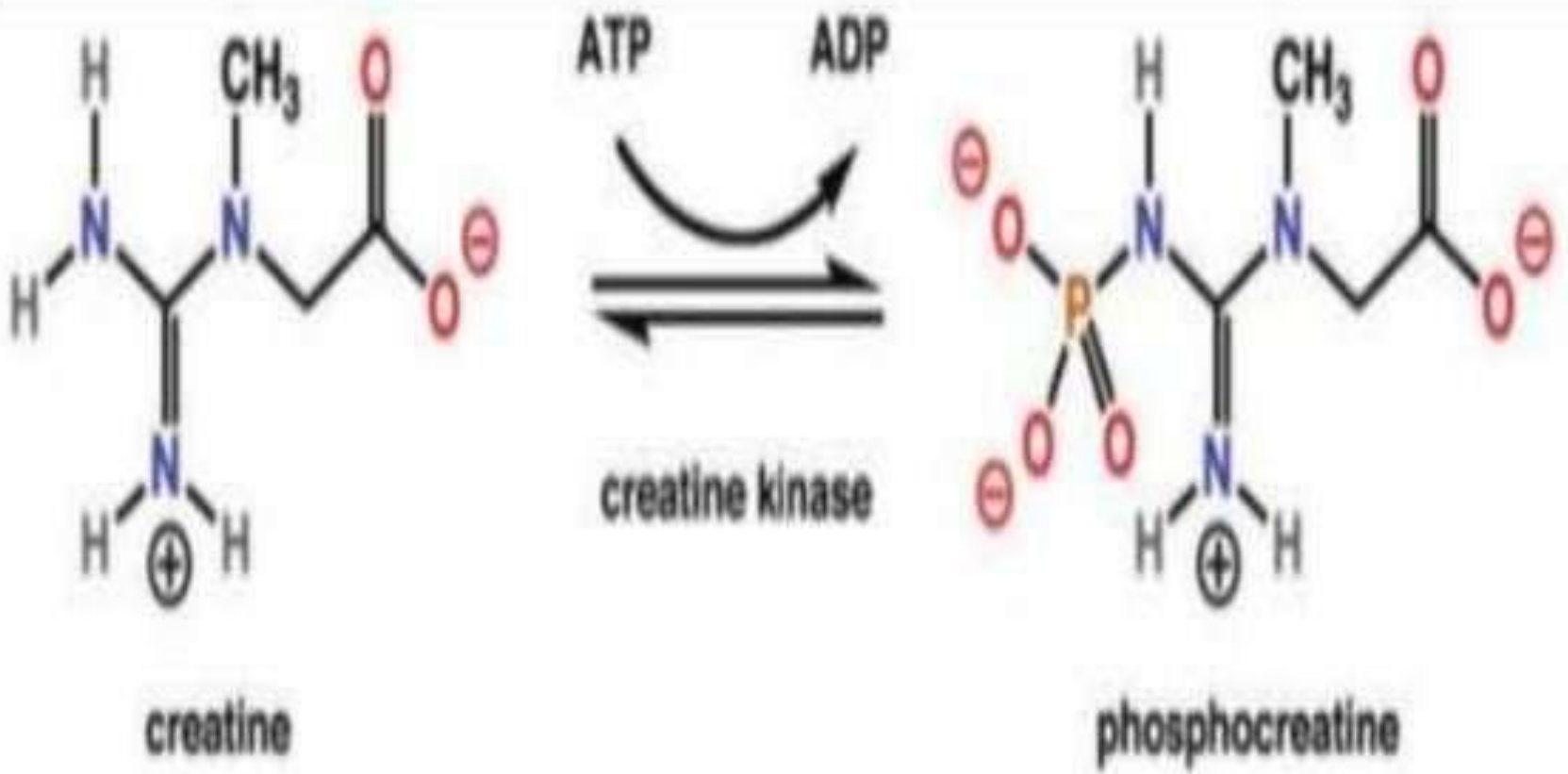


Figure: Synthesis of creatine kinase

4-Lactate Dehydrogenase (LDH)

LDH found throughout the body and catalyses the reversible oxidation of pyruvate to lactate. Increased serum LDH activity is a marker of hepatocyte damage, muscle damage and hemolysis. Normal value in serum is 60-200 IU/L.

5- Alkaline phosphate (ALP)

ALP catalyses the de-phosphorylation of ATP and has a maximum activity between pH9 and 10.5. Significance is cholestatic liver disease, osteosarcoma, pancreatic carcinoma, pancreatitis, hepatic necrosis, induction of drugs/hormones. Norm al level of ALP in serum is 10- 13 KA units/100ml.


Me
OH
Me
Me
Rb
Cs
Ba
Fr
Lr
Pm
Sm
Eu
Gd
Tb
Dy
Np
Pu
Am
Cm
Bk
Cf
100

6-Acid phosphatase (ACP)

Maximum activity of ACP is at pH5. Source are prostate, bone, liver, spleen, kidney, red blood cells and platelets. Significance is prostate cancer, bone disease, disease of blood cells, lysosomal disorders, and liver disease. Normal value is 1-5 KA units/100ml.

7-Amylase (AMS)

AMS catalyses the hydrolysis of complex carbohydrates. Significance is diagnosis of pancreatitis, renal failure or disorder. AMS is the smallest of all enzymes (55-60KD) and can easily pass through renal tubules.

8- Lipase (LPS)

LPS catalyses hydrolysis of triglycerides, releasing two fatty acids and monoglycerides. Significance is renal failure, pancreatic and extra pancreatic neoplasia, pancreatic acinar cell damage.

Clinical Chemistry

9-Glucose -6-phosphate to (G-6-PD)

They catalyses the oxidation of glucose-6-phosphate to 6-phosphogluconate and production of NADPH. Source is adrenal cortex, spleen and thymus, erythrocytes, which have very little activity in normal serum.

CLINICAL SIGNIFICANCE OF ENZYMES

Enzyme	function	Normal range	Occurrence	Clinical significance
Aldolase	F1,6 P → Triose Phosphate	1.5-7.2micromoles /l	Myocardium Skeletal muscles liver	Sensitive index in muscle wasting Muscular dystrophy Poliomyelitis Myasthenia Gravis
α-Amylase	Starch → Maltose	Serum – 50-120 IU/L URINE < 375 IU /L	Salivary gland Pancreas placenta	MUMPS > 1000IU/L Ectopic pregnancy Acute pancreatitis
Acid phosphatase (optimum p H)	Hydrolysis of esters of phosphoric acid	2.5 – 12 IU /L	Prostrate RBC WBC Platelet semen	PROSTRATE CANCER FORENSIC RAPE CASE
PSA-PROSTRATE SENTSITIVE ANTIGEN	(SERINE PROTEASE)	1 -5 MICROGRAM /L	Prostrate semen (LIQUIFICATION OF COAGULUM)	PROSTRATE CANCER (> 10 MICROGRAM /L)BEFORE RECTAL EXAMINATION BENIGN PROSTRATE ENLARGEMENT (5- 10 MICROGRAM /L)