ENZYMES
CARDIAC BIOMARKERS

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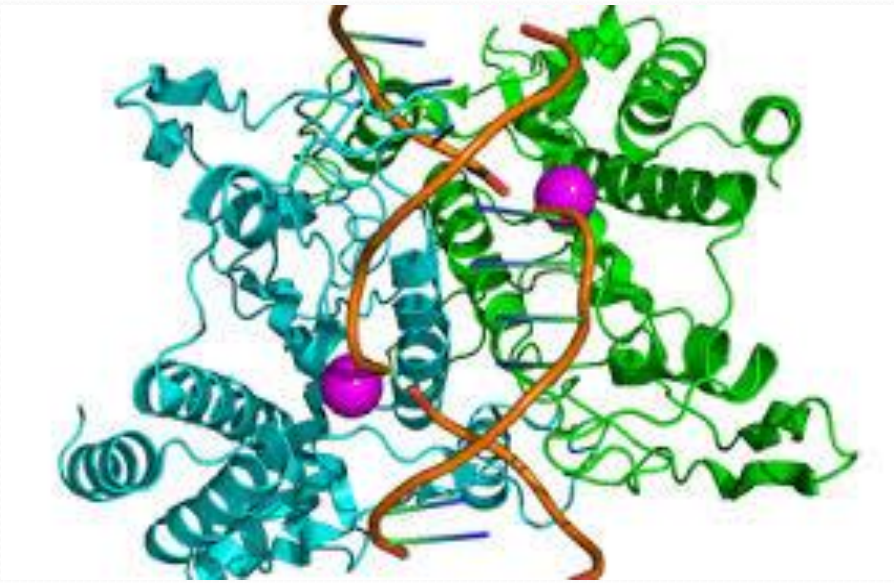
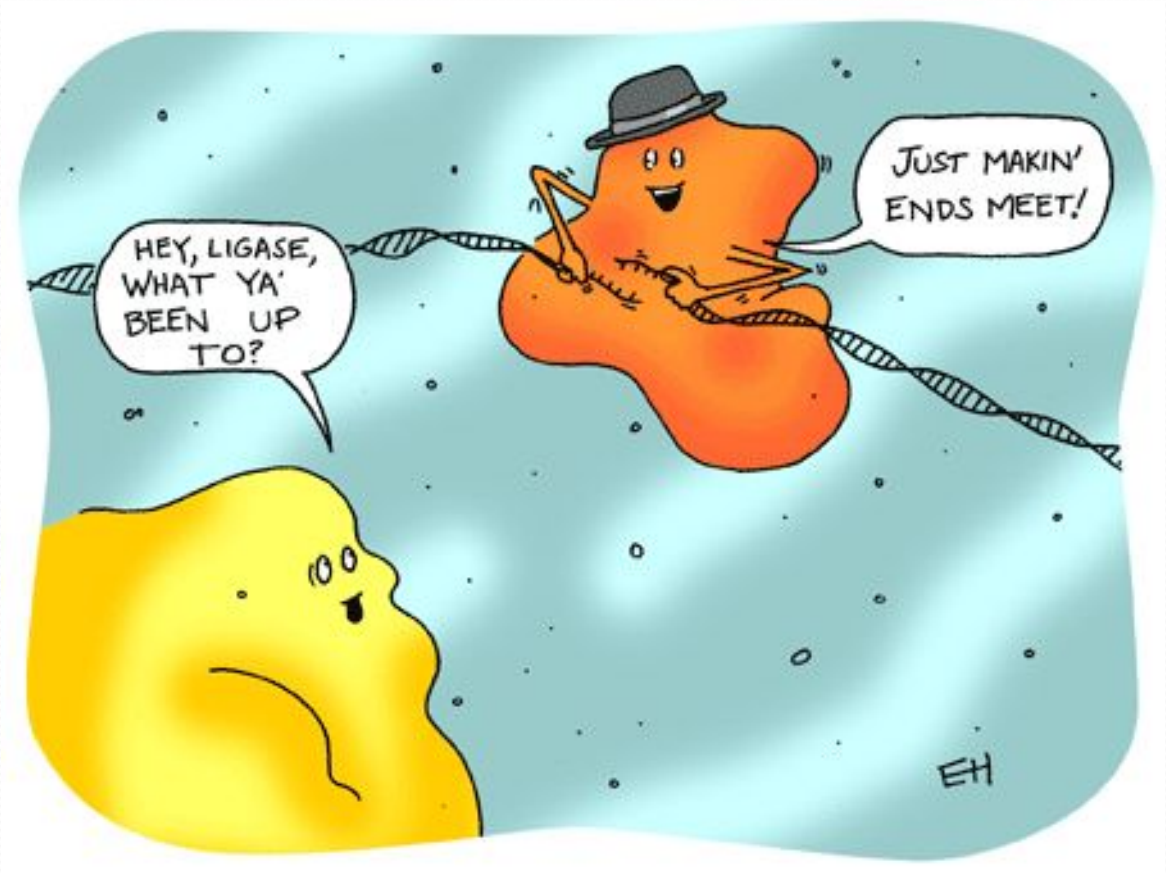
بسم الله الرحمن الرحيم

LEARNING OBJECTIVES

- To be able to
- Define Enzymes
- What Enzymes do
- What are Isozymes
- Identify the Enzymes which increase in Myocardial Infarction

WHAT DOES ENZYME DO ???

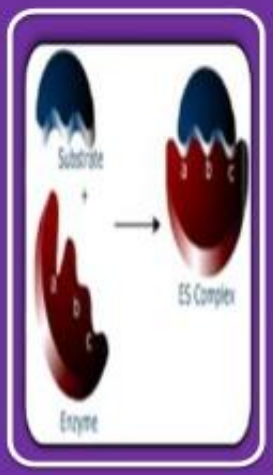



HEY, LIGASE, WHAT YA' BEEN UP TO?
JUST MAKIN' ENDS MEET!
EH

DEFINITION

Enzymes are reaction catalysts of biological systems i-e they are biological catalysts. Enzymes are COLLOIDAL,THERMOLABILE and PROTEIN in nature.

Definition of enzymes

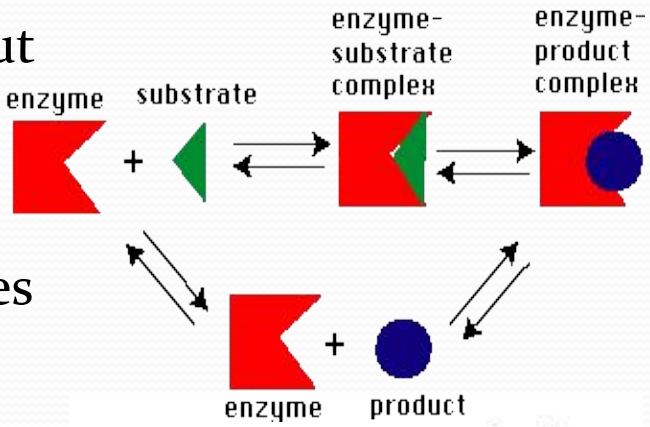


Enzymes

- Enzymes are proteins functioning as catalysts that speed up reactions by lowering the activation energy.
- The enzyme catalysts regulate the structure and function of cells and organisms.

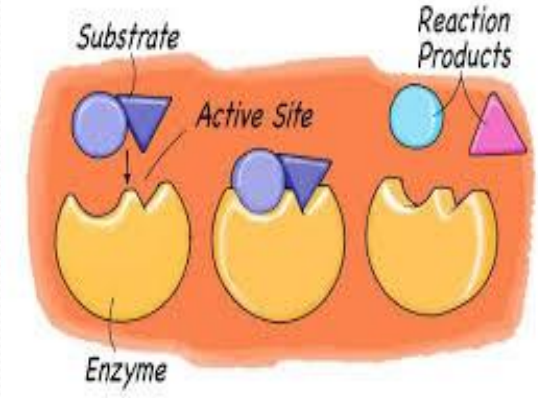
Definitions

- Catalyst
- substance that increase the velocity of chemical reaction without itself undergoing any change.



- Substrate
- substance on which enzymes act .

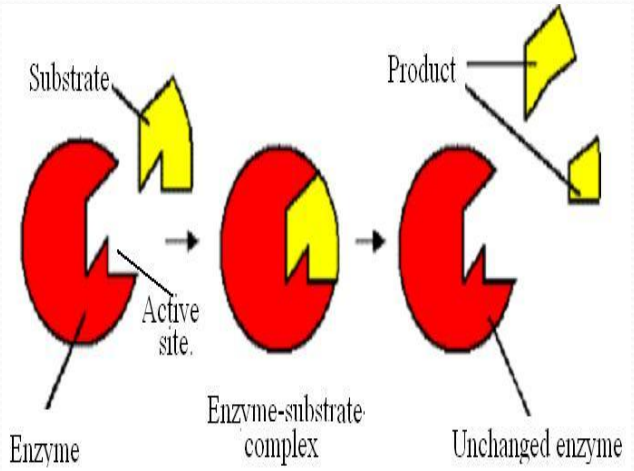
- Product
- substance produced by chemical reaction.
- Active site
- are on enzymes where substrate binds.



INTRODUCTION

- Enzymes are important group of biomolecules synthesized by the living cells.
- Enzymes only accelerate the rate of chemical reaction but do not initiate them . Chemical reactions can take place without enzymes but then reactions will be extremely slow.

- Actions of most enzymes are under strict regulation in a variety of ways.
- Enzymes that catalyze the conversion of one or more compounds (substrates) into one or more different compounds (products) enhance the rates of the corresponding non-catalyzed reaction by factors of atleast 10(6).
- Like all catalysts enzymes are neither consumed nor permanently altered as a consequence of their participation in a reaction.



ISOENZYMES

- Each of two or more enzymes with identical function but different structure.
- **Isozymes** (also known as **isoenzymes** or more generally as **Multiple forms of enzymes**) are enzymes that differ in amino acid sequence but catalyze the same chemical reaction.

- Isozymes were first described by R. L. Hunter and Clement Markert (1957) who defined them as *different variants of the same enzyme having identical functions and present in the same individual*.

- Isoenzymes are important as they are used for diagnostic and therapeutic purposes in the medical field.they serve as important biochemical markers.

- The enzyme Lactate Dehydrogenase is made of two different sub units (H-form and M-Form) combines in different Combinations depending on the tissue in which it is present giving 5 LDH isozymes:

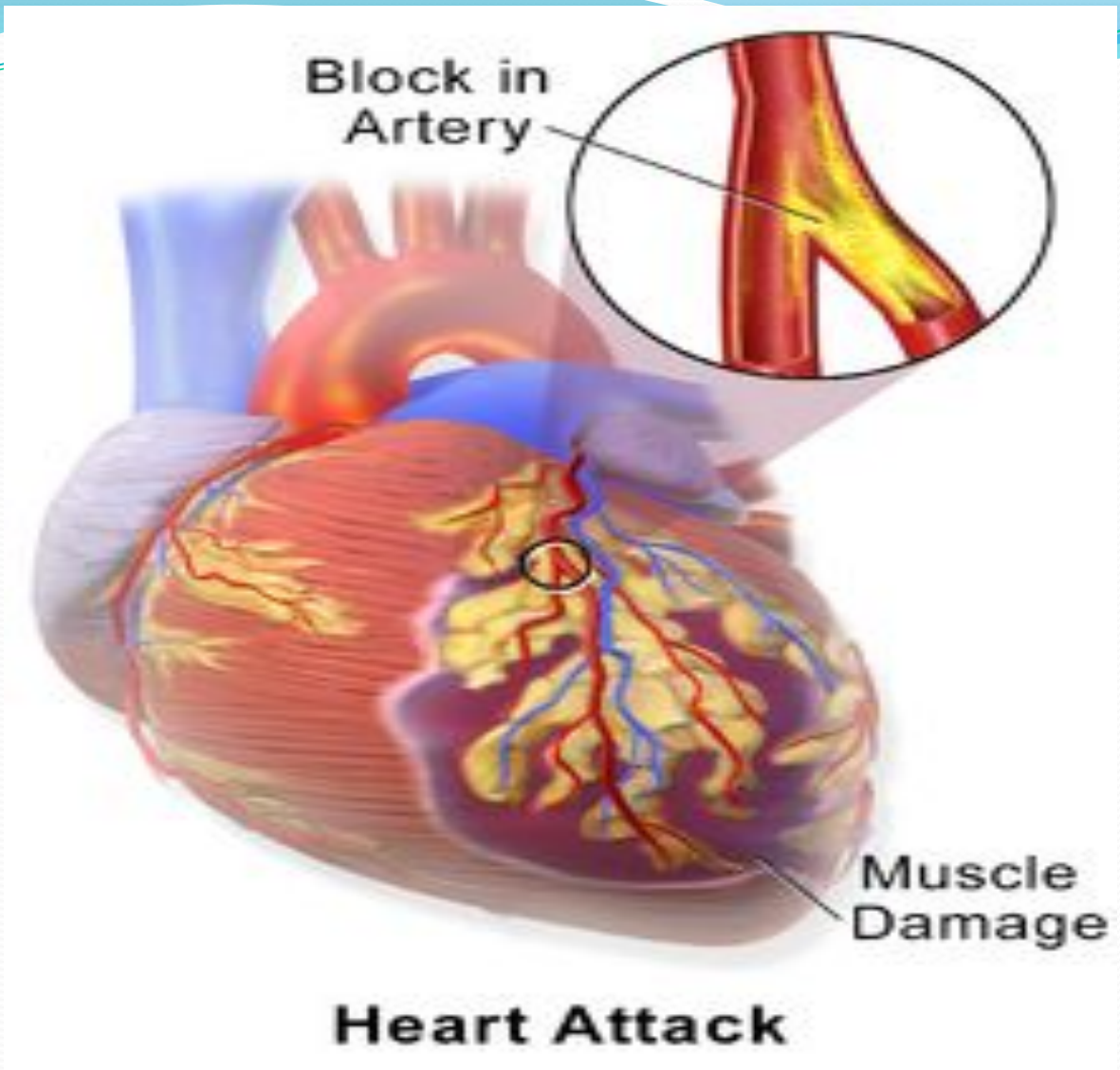
Type	Composition	Location
LDH_1	HHHH	Heart and Erythrocyte
LDH_2	HHHM	Heart and Erythrocyte
LDH_3	HHMM	Brain and Kidney
LDH_4	HMMM	Skeletal Muscle and Liver
LDH_5	MMMM	Skeletal Muscle and Liver

- The isozyme I1 predominates in the heart and the I5 in the liver.Thus tissue injury releases a characteristic pattern of LDH isozymes that can be separated by electrophoresis and using a coupled assay.

LDH Stds
Heart cytosol
Heart mito
Liver mito
Liver cytosol
Liver periplasmic
Liver mito inner membrane
(M4) 5
(HM3) 4
(H2M2) 3
(H3M) 2
(H4) 1
-
0
+

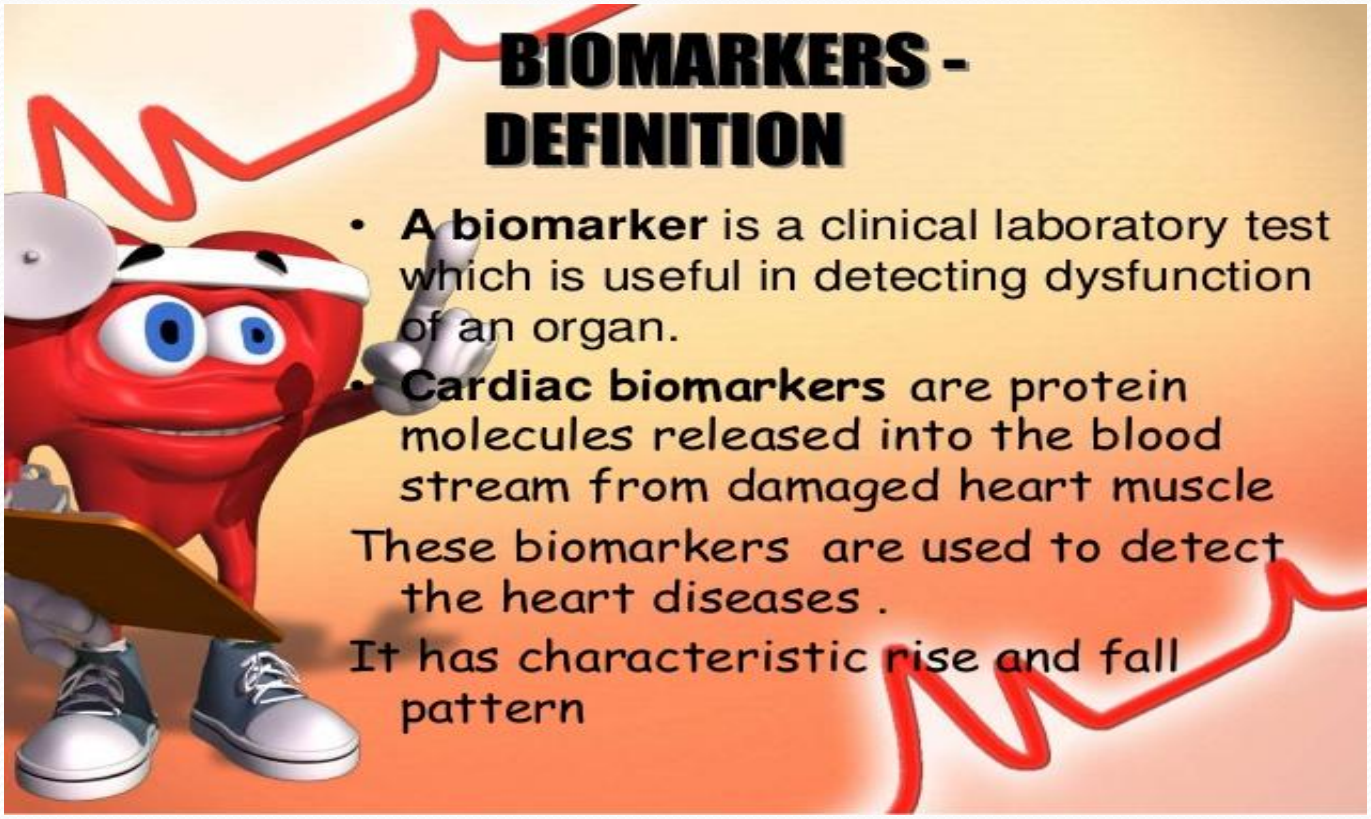
ENZYMES FOR DIAGNOSIS AND PROGNOSIS

Cardiac enzyme evaluation



Heart Attack

CARDIAC BIOMARKERS



Cardiac Enzyme Test

A cardiac enzyme test is a blood test that measures cardiac enzyme levels to assess how well the cardiovascular system is functioning.

CARDIAC BIO MARKERS

- TROPONINS
- CREATININE PHOSPHO KINASE
- LACTATE DEHYDROGENASE

TROPONINS

- **Troponin** is a type of protein found in the muscles of heart. **Troponin** isn't normally found in the blood. When heart muscles become damaged, **troponin** is sent into the bloodstream. As heart damage increases, greater amounts of **troponin** are released in the blood.

- TYPES OF TROPONINS:
- Troponin is a complex of three regulatory proteins
- Tnt (troponin T)
- Tni (troponin I)
- Troponin C
- that is integral to muscle contraction in skeletal and cardiac muscle, but not smooth muscle.

CLINICAL SIGNIFINANCE OF TROPONIN

- TROPONIN T and TROPONIN I
- For Diagnosis of ACS…Acute Coronary Syndrome (highly sensitive and specific)
- For prognosis of ischemic events
- Appears in Plasma with in 4to 6 hrs after ACS
- Peaks in 8-24 hrs.
- Remains elevated 3-10 days

CREATINE PHOSPHOKINASE

Has three isoenzymes:

CK-MM (sk.musc)

CK-BB (brain)

CK-MB (heart & sk.musc)

CLINICAL SIGNIFICANCE OF CPK

- For Diagnosis of ACS
- For Reinfarction
- Appears in serum 4-8 hrs after chest pain
- Peaks in serum at 24 hrs
- Return to base line after 48-72 hrs.

S-GLUTAMATE OXALOACETATE TRANSAMINASE

- Serum Glutamic Oxaloacetic Transaminase (SGOT) is an enzyme that is normally present in liver and heart cells. It is released into blood when the liver or heart is damaged. Blood levels of SGOT are elevated with liver damage or with an insult to the heart. SGOT is also called aspartate aminotransferase (AST). A high level of SGOT released into the blood may be a sign of liver or heart damage, cancer, or other diseases.

LACTATE DEHYDROGENASE

- LDH has two isozymes .....LDH1 and LDH 2

An **LDH**-1 level higher than the **LDH**-2 level suggests myocardial infarction (damage to heart tissues releases heart **LDH**, which is rich in **LDH**-1, into the bloodstream).

- The use of this phenomenon to diagnose infarction has been largely superseded by the use of Troponin I or T measurement.
- Rise begins in 12-18 hrs
- Peak activity for 72 hrs
- Normalises in 10-14 days

SERUM ENZYMES IN MI

NAME OF ENZYME	RISE BEGINS	PEAK ACTIVITY	RETURN TO NORMAL
TROPONIN T/I	4to 6 hrs	8-24 hrs	After 10 days
CREATINE PHOSPHO-KINASE	4 hrs	24 hrs	2-4 days
S-GLUTAMATE OXALOACETATE TRANSAMINASE	12-18 hrs	24 hrs	5 days
LACTATE DEHYDROGENASE	12-18 hrs	72 hrs	10-14 days


That's all Folks!