

Medicinal

BIOCHEMISTRY

ISOENZYMES

DEFINITION

FORMATION

APPLICATIONS

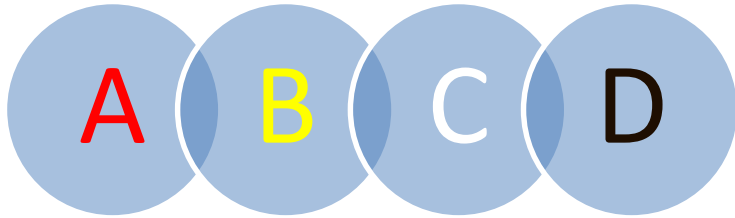
What are Isoenzymes

Iso enzymes are enzymes that catalyze identical chemical reactions

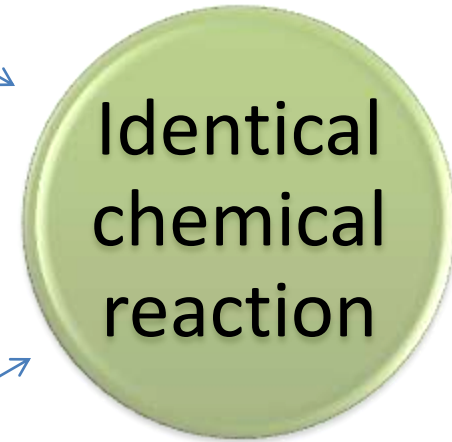
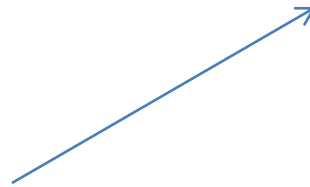
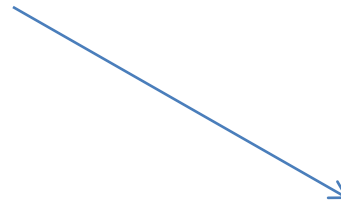
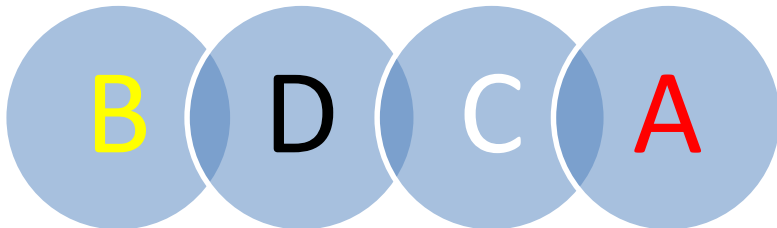
But they differ in their amino acid sequence

For Better Understanding

- Enzymes



Isoenzymes

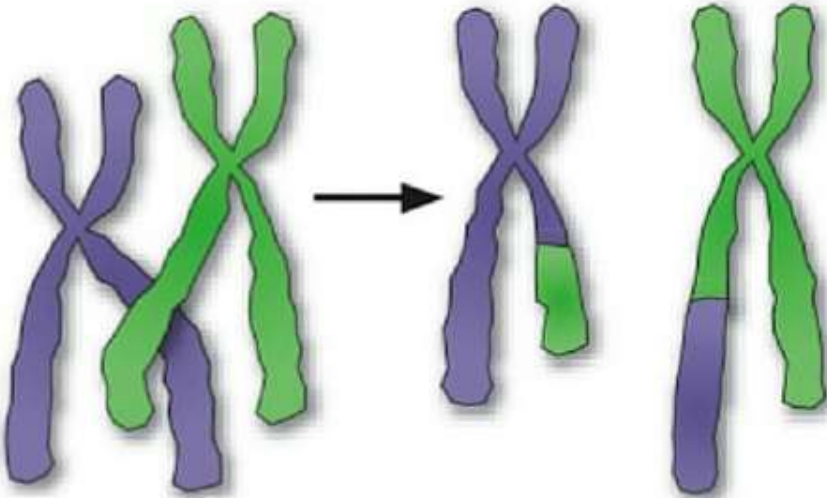


HOW ARE THEY FORMED ?

formed due to homologous or recombination of
gene pair

i.e. During Gene duplication the duplicate code
is retained which leads to formation of
isoenzymes

Gene duplication



Isoenzymes

Varied amino acid sequence

APPLICATIONS

Diagnostic

Therapeutic

Biochemical markers

Treatment of Disease

Analytical Reagents

**Enhance normal
functioning**

Diagnosis



Cardiac Disease

Muscle disease

Bone disease

Hepatic Disease

Cardiac Biomarkers - MYOCARDIAL INFARCTION

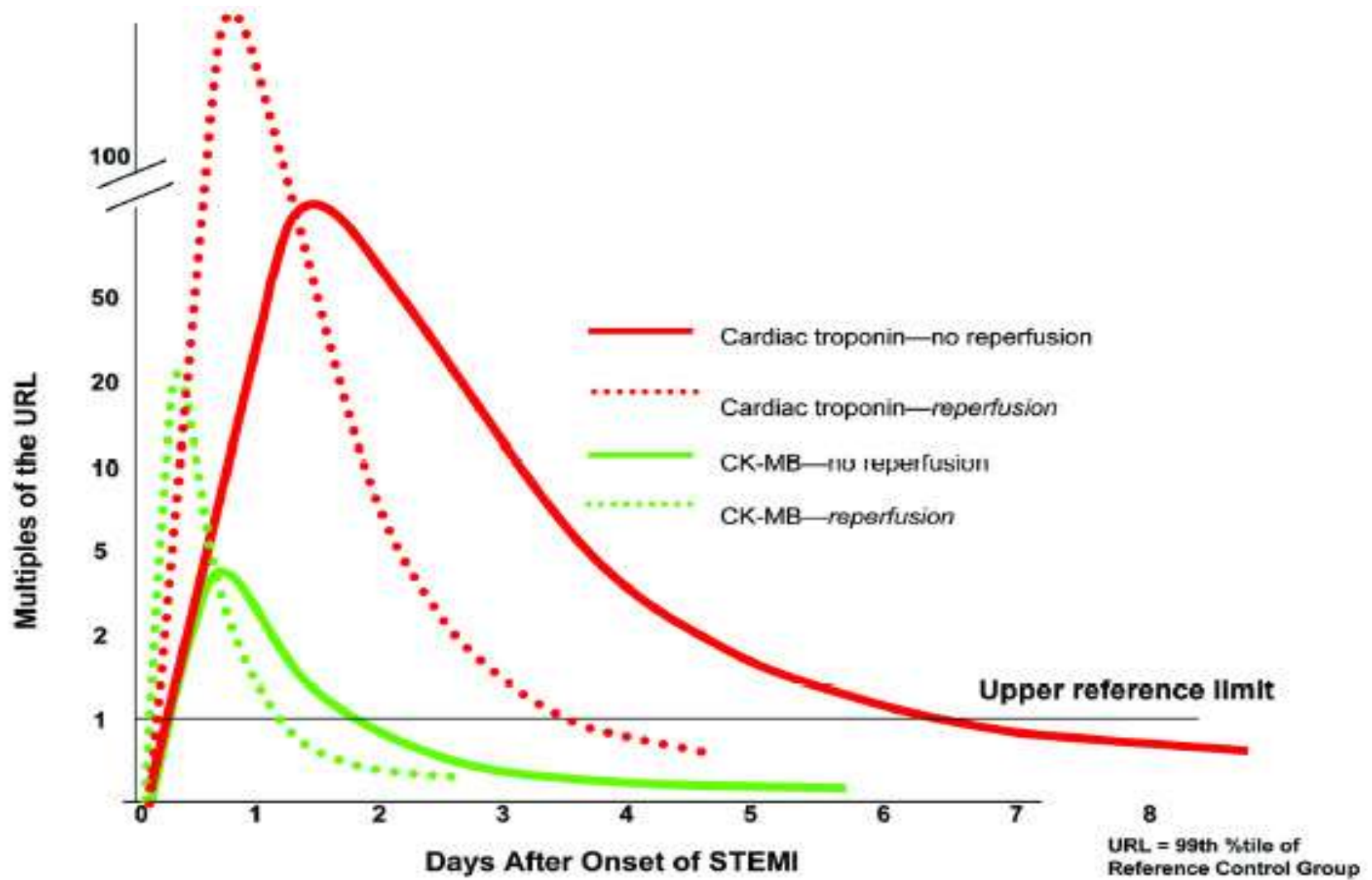
Troponin test

- ✓ Superior marker for myocardial injury
- ✓ Increases within 12 hrs

Creatine Kinase –MB

- ✓ Relatively Specific in the absence of skeletal muscle damage
- ✓ Increases within 10-24 hrs

For easy understanding...



Enzymes used in diagnostic

purpose

| Enzymes | Used for testing |
|-----------------|------------------|
| Urease | Urea |
| Uricase | Uric acid |
| Glucose oxidase | Glucose |

Alkaline phosphatase(ALP)

- ❑ Enzyme that removes phosphate groups from molecules in the body
- ❑ Important for correct function of liver, Intestines and placenta.
- ❑ Abnormal levels of ALP indicate a variety of conditions including liver disease, bone disease and pregnancy

Alkaline phosphatase (ALP)

- Also involved in Growth
- High level of ALP isoenzyme



New bone formation

Lactate dehydrogenase (LDH)

- ❖ Essential for anaerobic respiration
- ❖ During low oxygen level...



Lactate



Source of muscular energy

LDH exist in five varieties in Human body

LDH-1

LDH-2

LDH-3

LDH-4

LDH-5

Multiple forms of Enzymes...

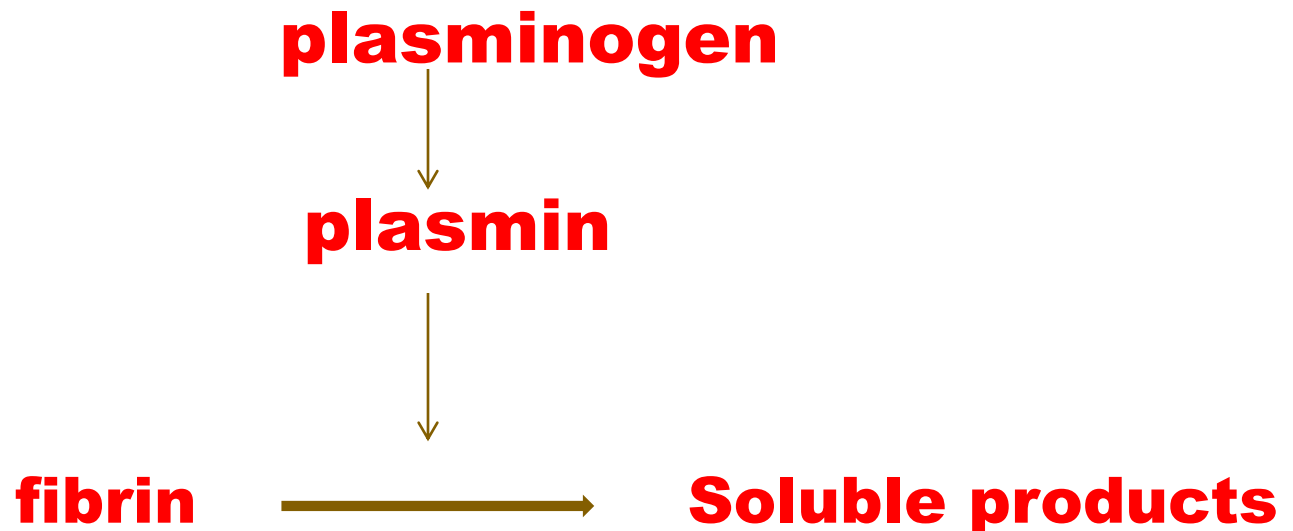
| Examples | Locations |
|-----------------------|-----------------------|
| Alcohol dehydrogenase | Yeast/mammalian liver |
| Alkaline phosphatase | Bone/intestine/liver |
| Lactate dehydrogenase | Mammalian tissues |
| Malate dehydrogenase | Mitochondrial/soluble |

THERAPEUTIC APPLICATIONS OF ENZYMES

| ENZYME | APPLICATION |
|--|---------------------------------------|
| Streptokinase/ urokinase | To remove blood clots |
| Asparaginase | In cancer therapy |
| Papain | Anti-inflammatory |
| Alpha1-antitrypsin | To treat emphysema |
| Pancreatic enzymes (trypsin , lipase) | For digestion (pancreatic Disease) |

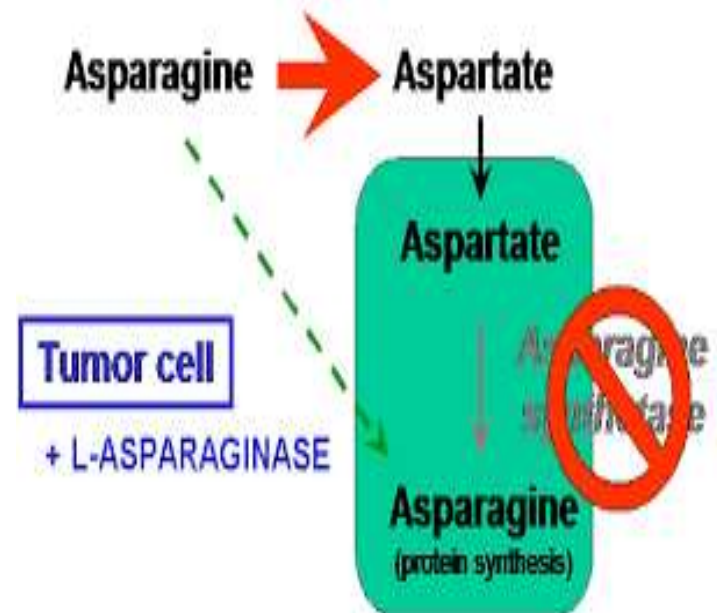
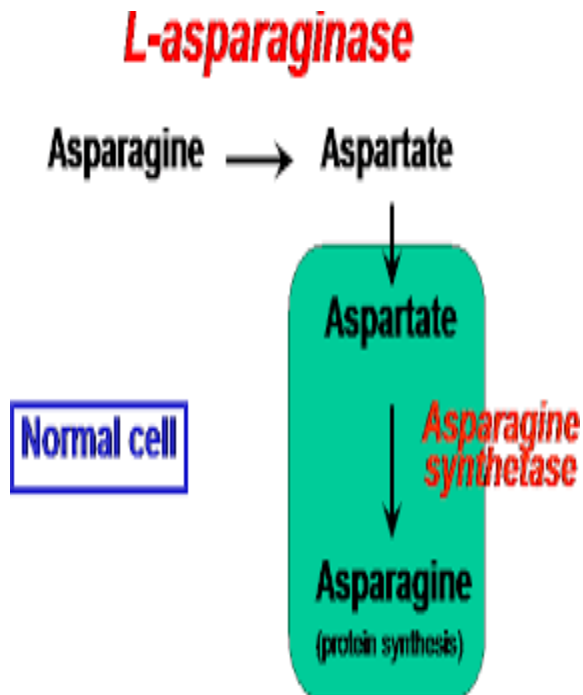
Streptokinase/ urokinase

- Streptokinase prepared from streptococcus is Useful for cleaning the blood clot.
- Streptokinase activates plasma plasminogen to plasmin which , in turn ,attacks fibrin to convert into soluble product.



ASPARAGINASE

- The enzyme asparaginase, is used in the treatment of leukemias.



PAPAIN

- **Papain**, also known as **papaya proteinase I**, is a cysteine protease ,enzyme present in papaya (*Carica papaya*) and mountain papaya.

USES

- Papain breaks down tough meat fibres .
- Papain can be used to dissociate cells in the first step of cell culture preparations.
- Papain is also used in some toothpastes and mint sweets as a tooth whitener .

ANALYTICAL APPLICATION REAGENTS

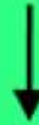
| ENZYMES | APPLICATION |
|--|---|
| Glucose oxidase and peroxidase | glucose |
| urease | urea |
| Cholesterol oxidase | cholesterol |
| lipase | triacylglycerols |
| Luciferase | To detect bacterial contamination of food |
| Alkaline phosphate/ Horse radish peroxidase | In the analytical technique ELISA |
| | |

ELISA

- The **enzyme-linked immuno sorbent assay (ELISA)** is a test that uses antibodies and color change to identify a substance.
- The ELISA has been used as a diagnostic tool in medicine and plant pathology, as well as a quality-control check in various industries.

Illustration of ELISA

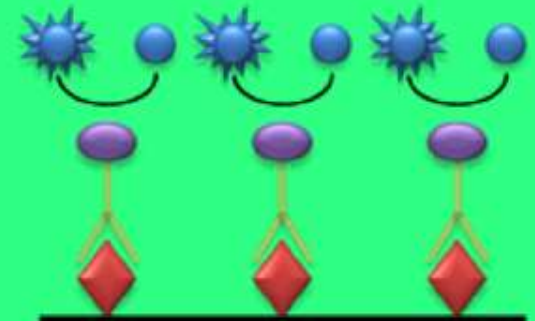
Virus Sample on Surface



Antibody with enzyme
conjugate attached to
viral antigen



Substrate and enzyme
interaction create color
change for detection



APPLICATION IN GENETIC ENGINEERING

| ENZYMES | APPLICATION |
|---------------------------|--------------------------------------|
| Restriction endonuclease | Gene transfer , DNA finger printing. |
| <i>Taq</i> DNA polymerase | Polymerase chain reaction |

Industrial applications

| ENZYME | APPLICATION |
|--------------------|-----------------------------------|
| Renin | Cheese preparation |
| Glucose isomerase | Production of high fructose syrup |
| α - amylase | In food industry |
| proteases | Washing powder |