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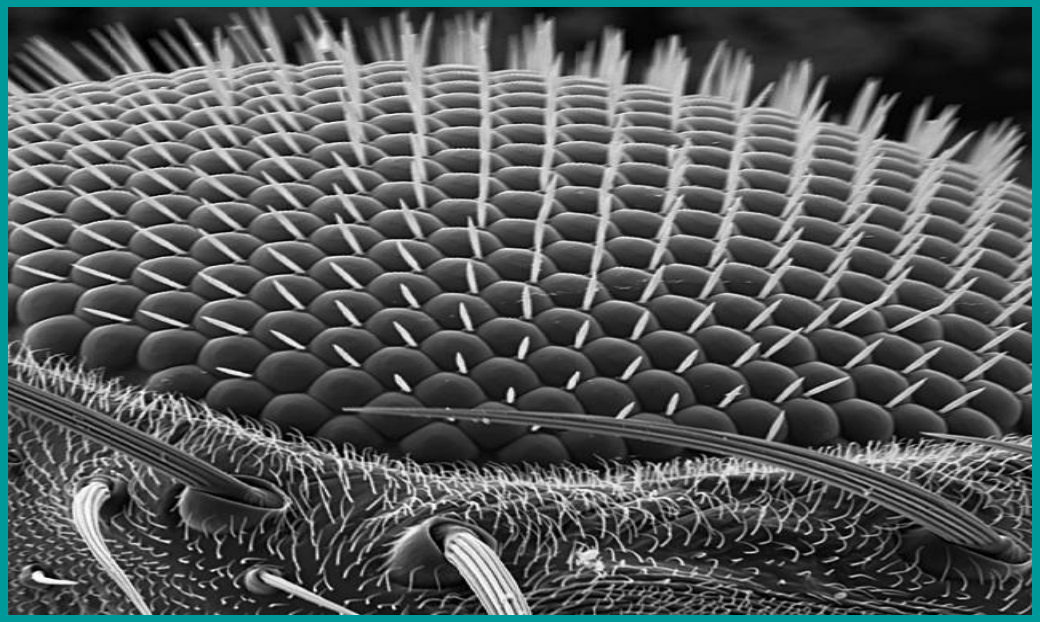
Creations

ENZYMES



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Enzymes are essential to life

Enzymes are the foundation of energy and the life force in all living things. Without enzymes, seeds would not sprout, fruit would not ripen, leaves would not change color, and you would not exist. Enzymes are responsible for **building**, **detoxifying**, and **healing** your body. They are the force that allow your body to **digest** and **absorb** food.

Clinically important enzymes:

- Muscle enzymes
- Liver enzymes
- Pancreatic enzymes

Other clinically important enzymes:

- Acid phosphatse
- Glucose-6-phosphate dehydrogenase

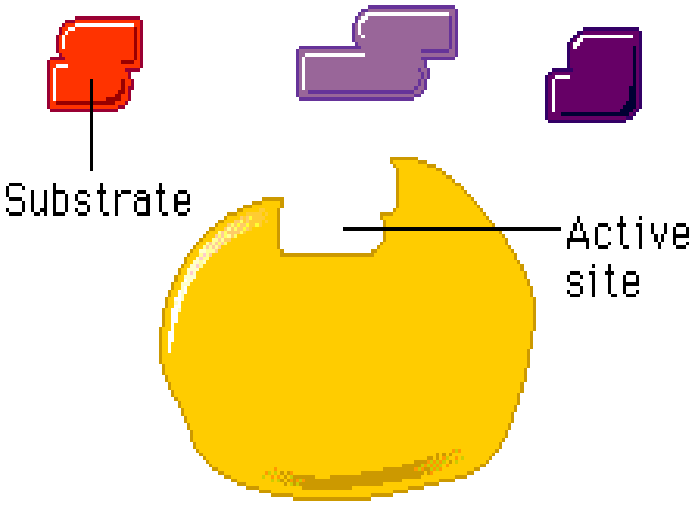
A **catalyst** is a substance that **speeds up** a chemical (metabolic) reaction. The catalyst itself **is not used up** as a result of its actions. **Proteins** that function as biological catalysts are called **enzymes**. They are composed of C, H, O and N. Sulphur (S) may also be present

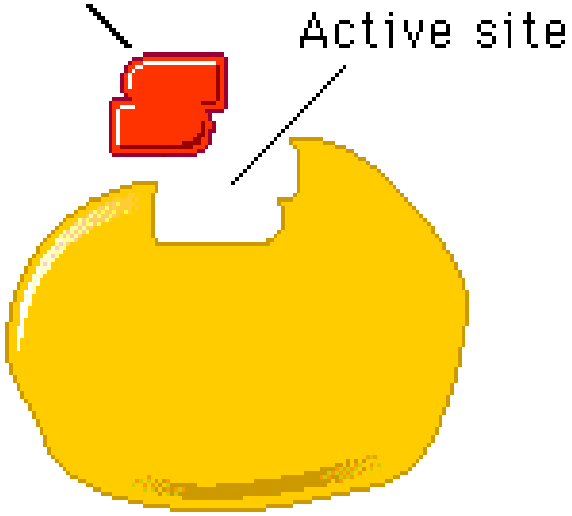
Enzymes control cellular reactions. As you remember, reactions that break down substances and **release energy** are called **catabolic reactions**. Examples are **respiration** and **digestion**. The other types of reactions are called **anabolic reactions**. These reactions **consume (use) energy**. These reactions build larger, more complex, molecules from smaller ones. **Photosynthesis** and **muscle growth** from amino acids are examples of anabolic reactions.

ENZYME ACTION

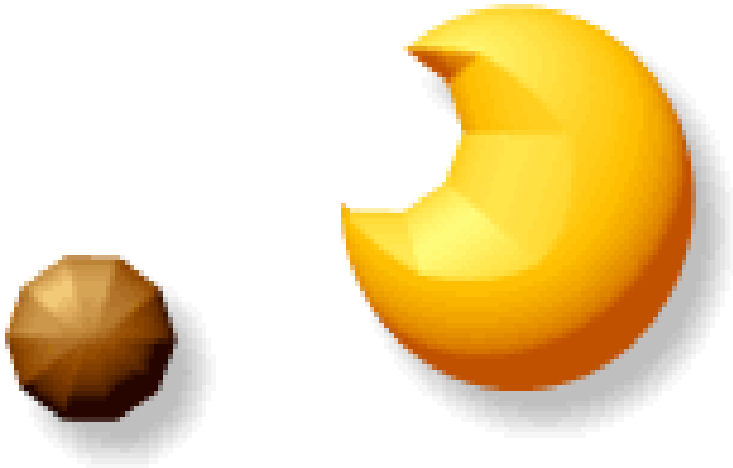
Enzymes are folded in GLOBULAR SHAPES:

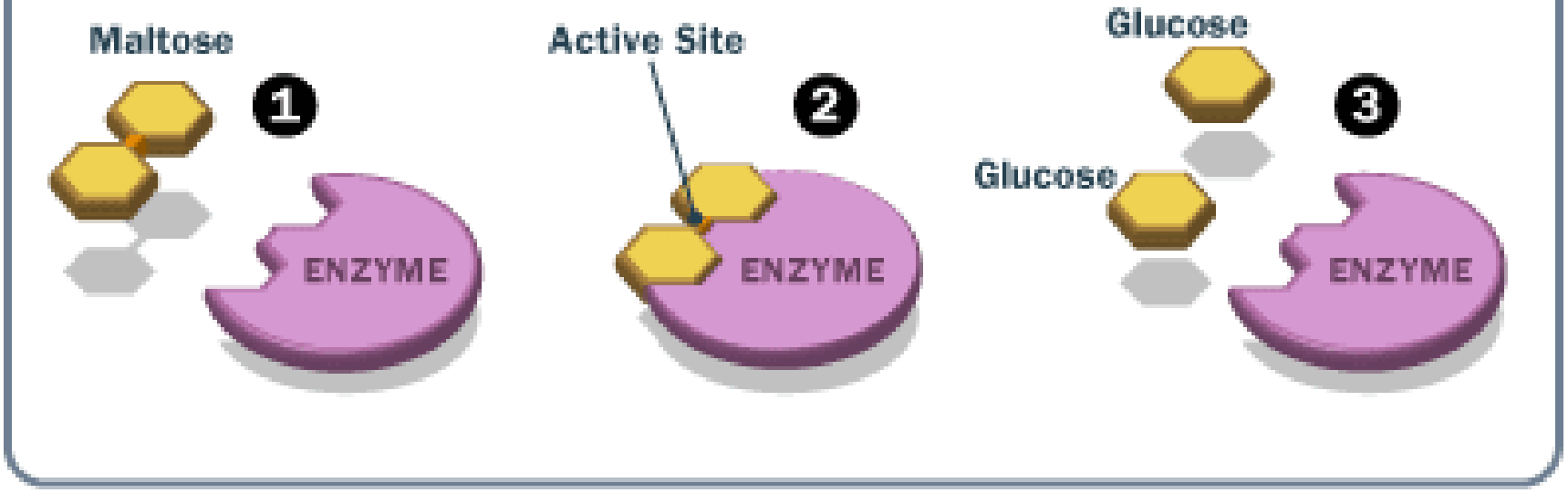
The enzyme's shape enables it to receive only one type of molecule; that molecule that will fit into it's shape. The place where the substance fits into the enzyme is called the **active site** and the substance that fits into the active site is called the **substrate.**

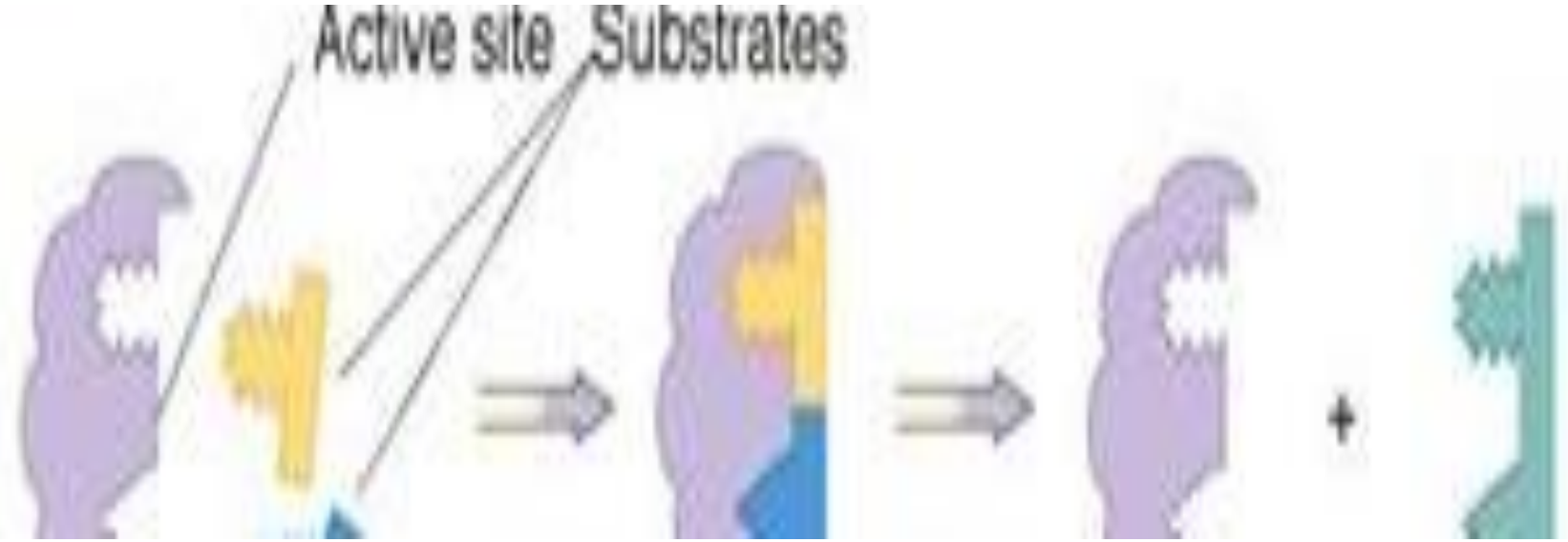




Enzyme action occurs when the enzyme and substrate collide. During the collision the substrate slots into the active site of the enzyme. Collisions happen because of the rapid random movement of molecules. When the substrate joins with the enzyme the entire structure is called the **enzyme-substrate complex**. The substrate becomes **changed** by the enzyme's action and is then releases as the **product**. The enzyme is then free to join another substrate.



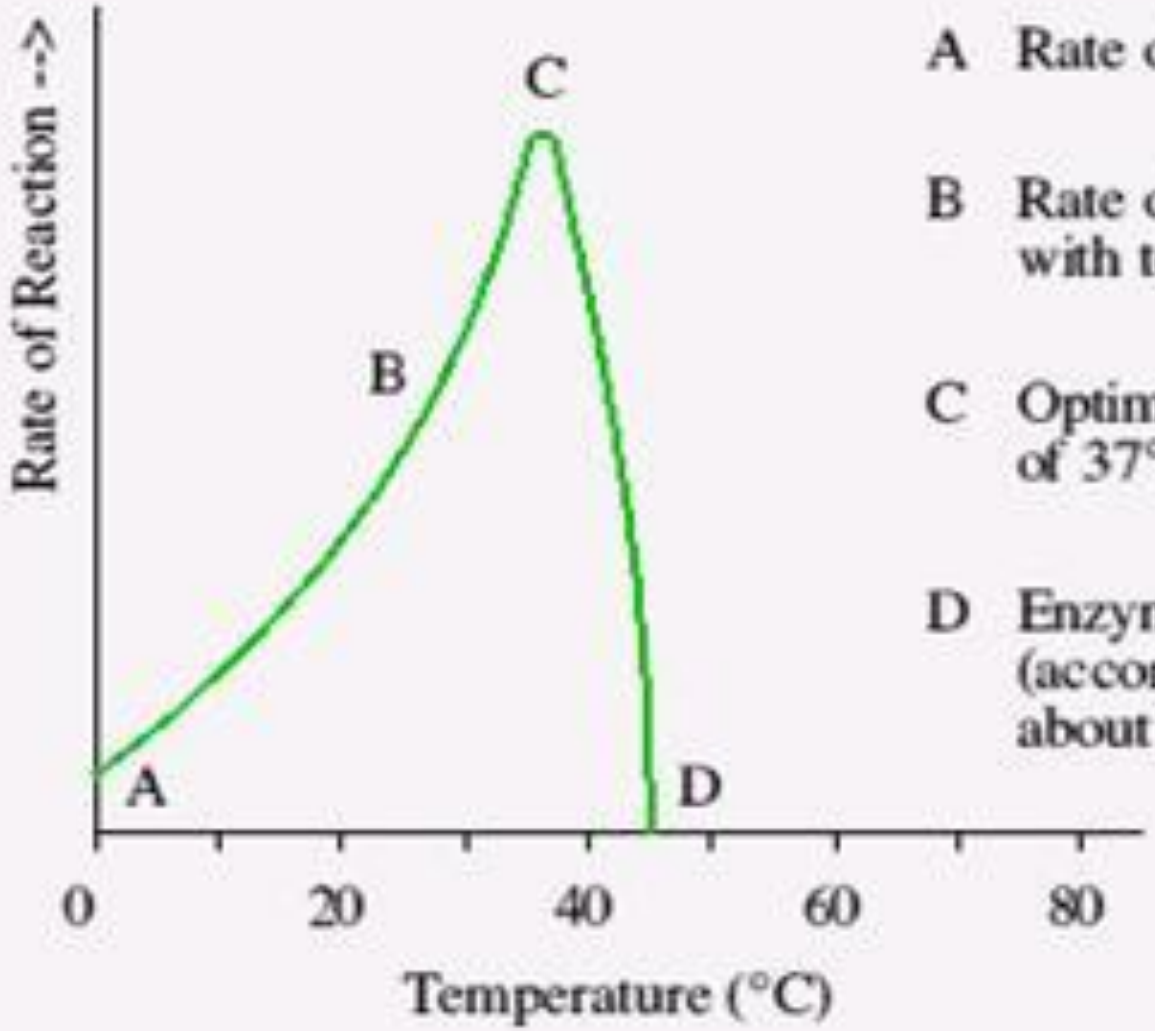

Maltose
1
ENZYME
Active Site
2
ENZYME
Glucose
Glucose
3
ENZYME


Active site
Substrates

Enzymes can be either anabolic or catabolic. The same enzyme can be used to form smaller molecules from a larger molecule or to do the opposite.

- An example of a **catabolic enzyme** is **amylase. Amylase** converts starch into maltose.
- An example of an **anabolic enzyme** is **DNA polymerase**. This enzyme **repairs (rebuilds) DNA.**

PREDICTED RATES OF REACTION

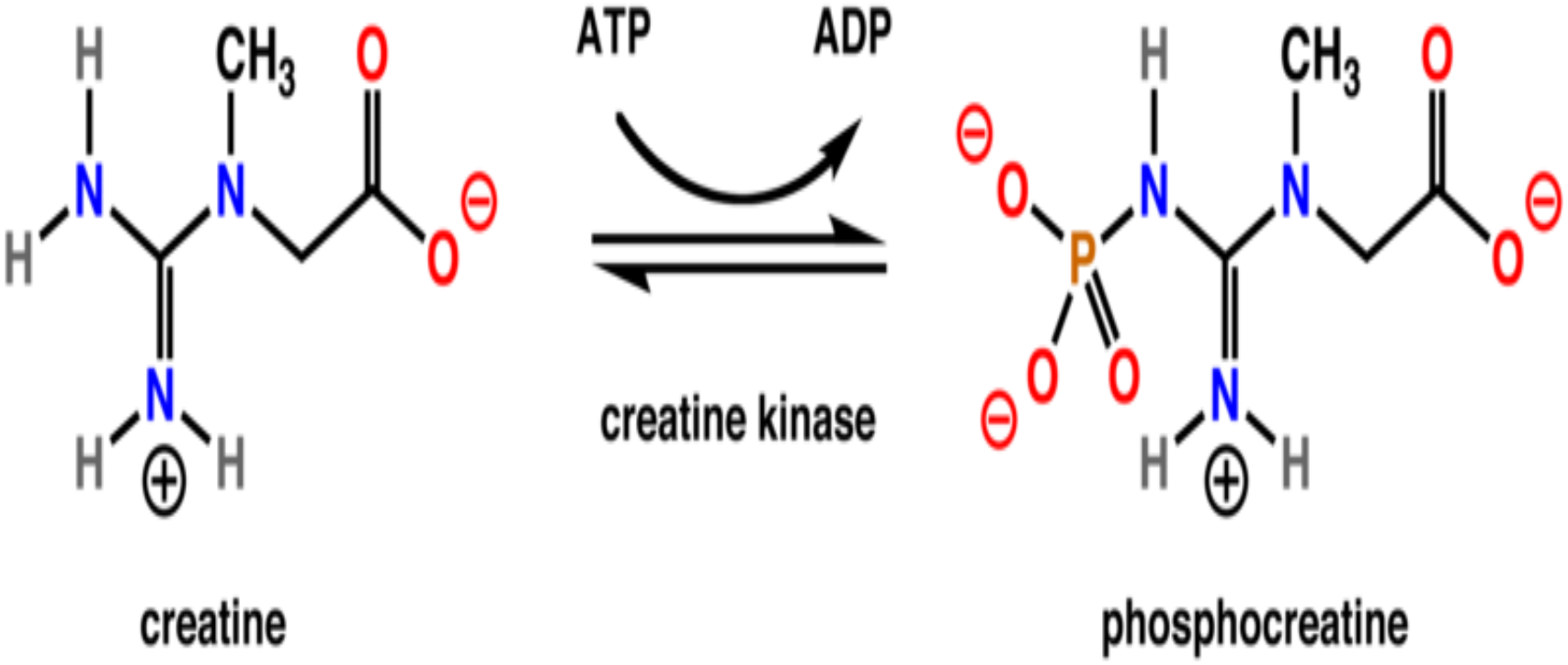


A Rate of reaction very slow

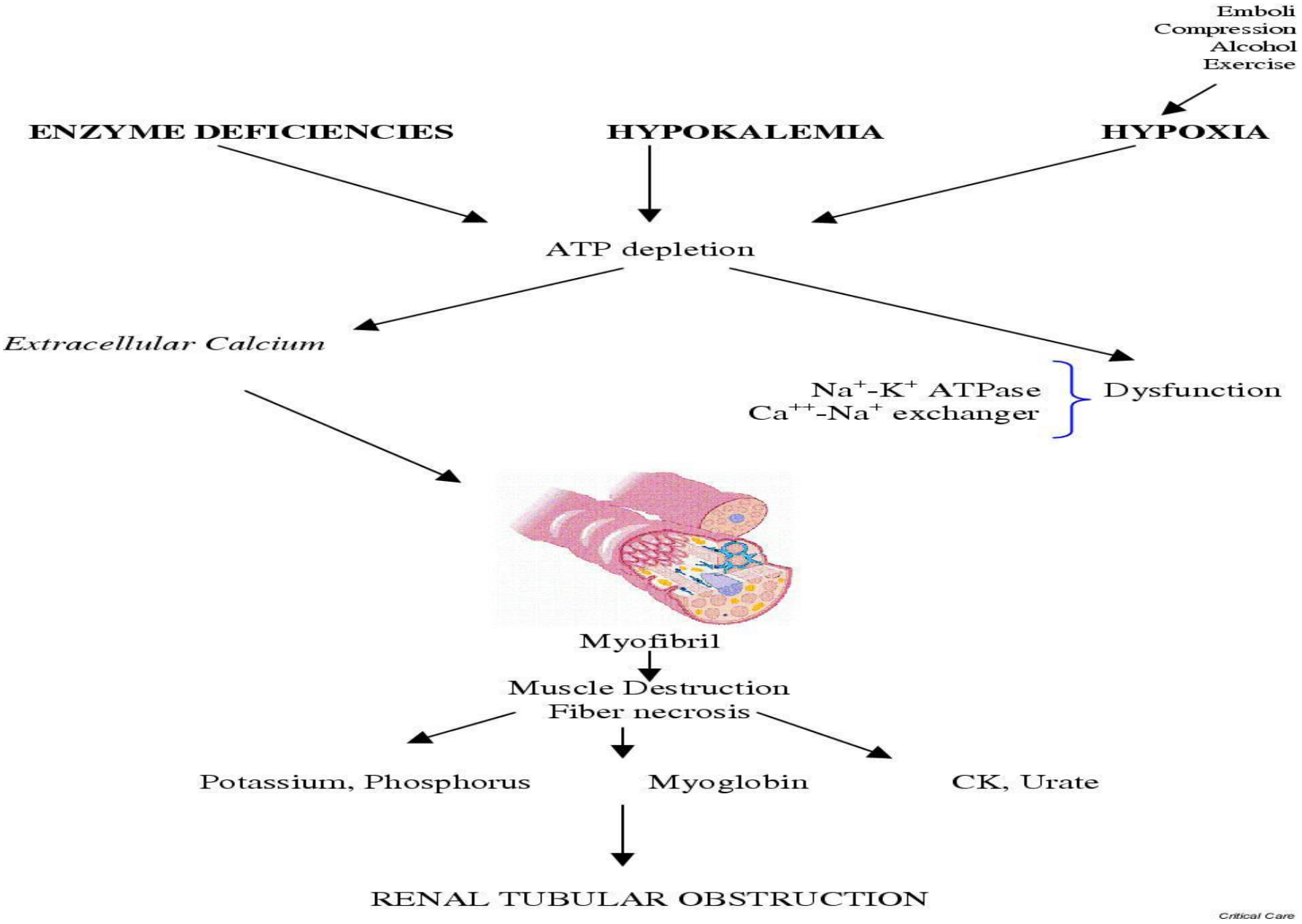
B Rate of reaction increases with temperature

C Optimum temperature of 37°C

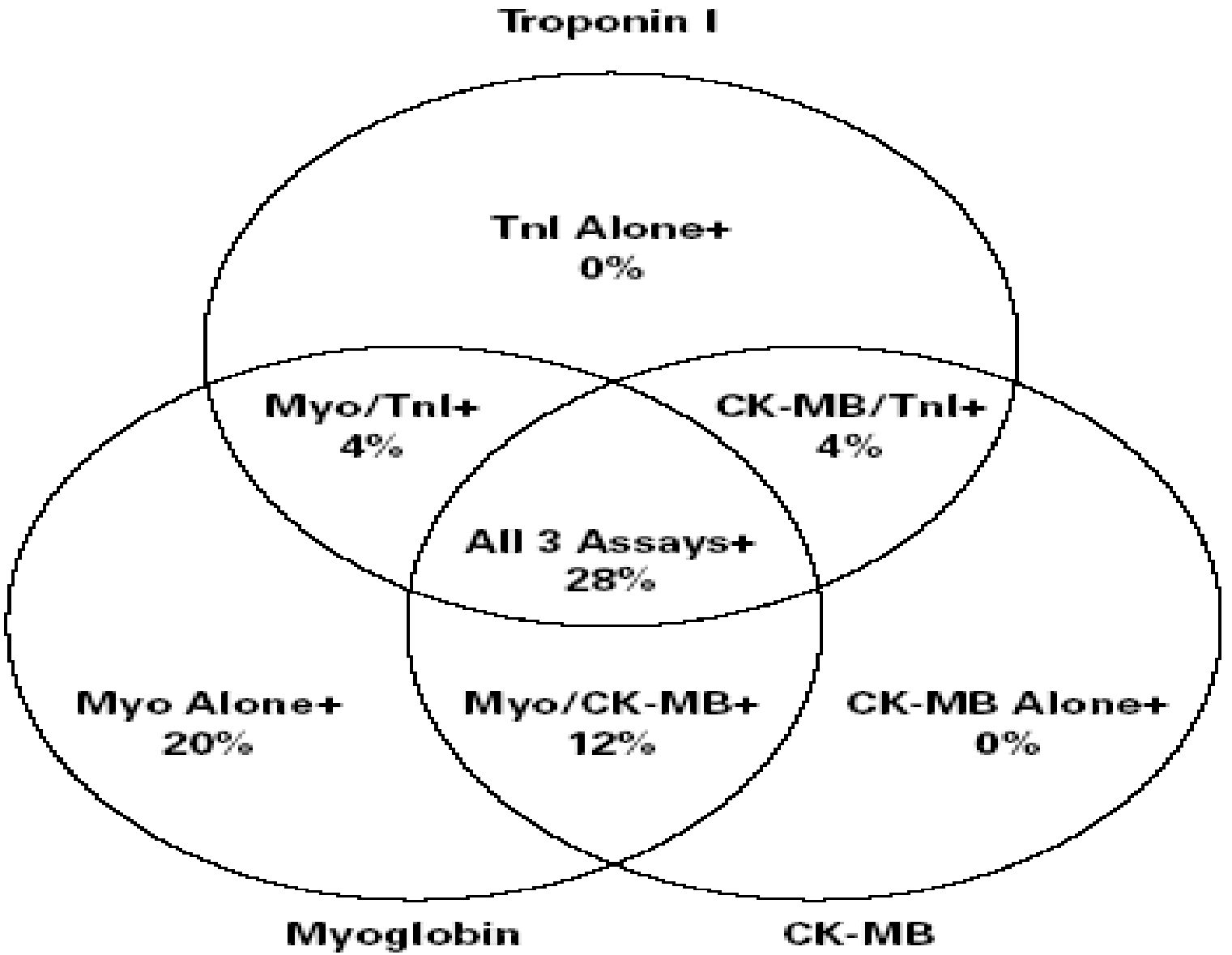
D Enzyme denatured at (according to books) about 45°C



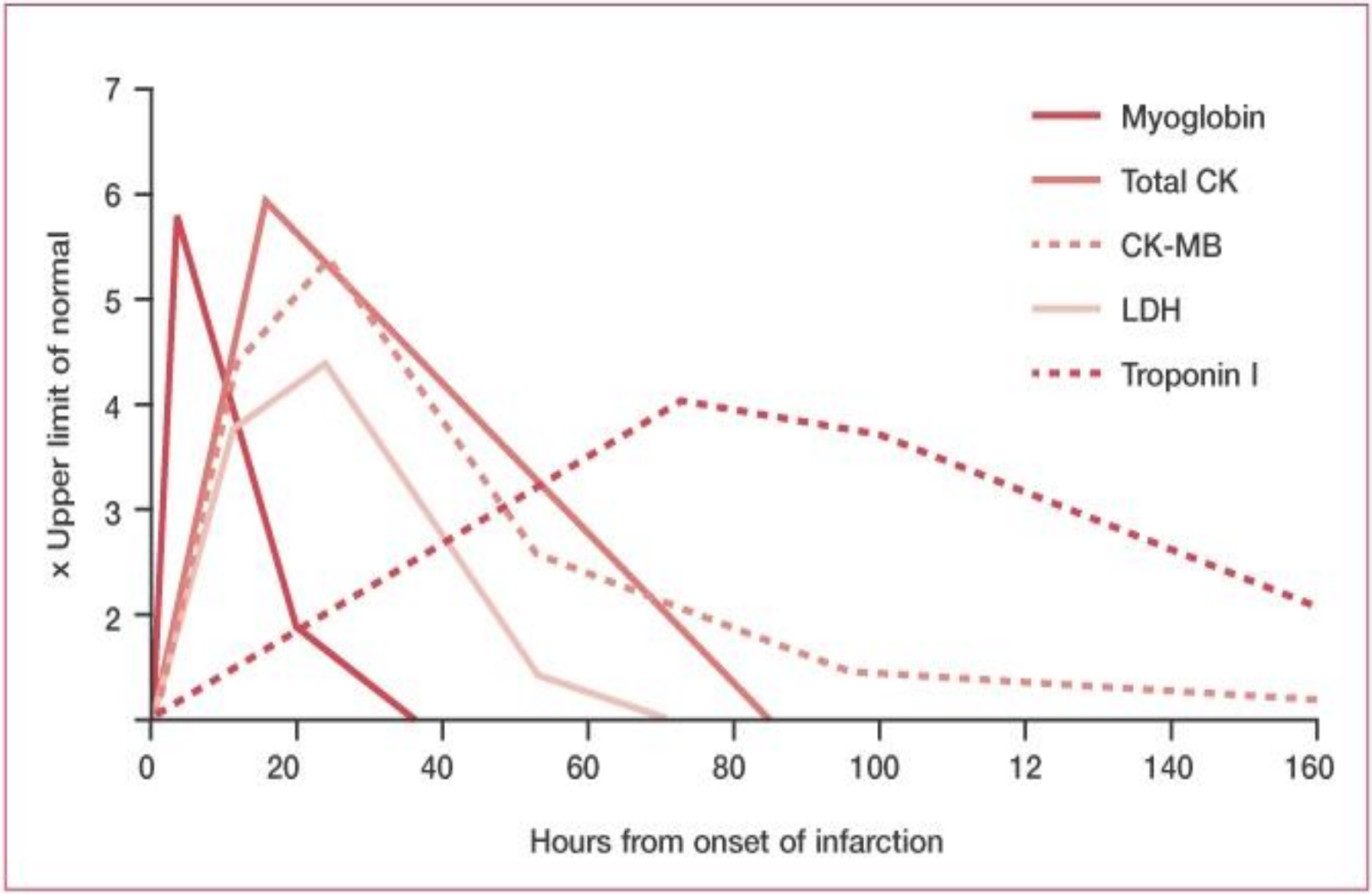
Creatine kinase (CK) (EC 2.7.3.2) is a dimeric enzyme (82kDa) that catalyzes the reversible phosphorylation of creatine (Cr) by adenosine triphosphate (ATP).

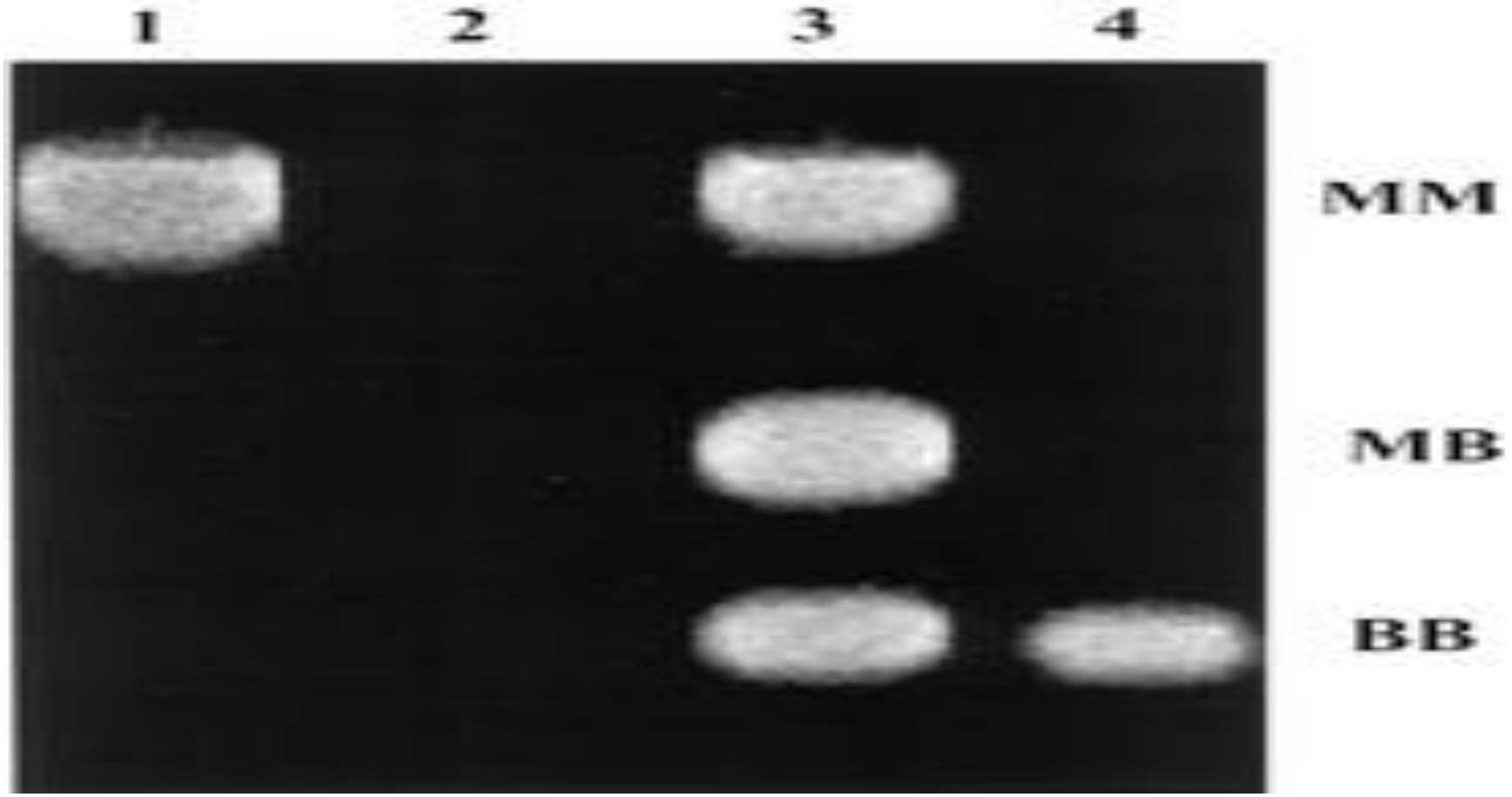


Overview of the pathophysiology of rhabdomyolysis. CK, creatine kinase.



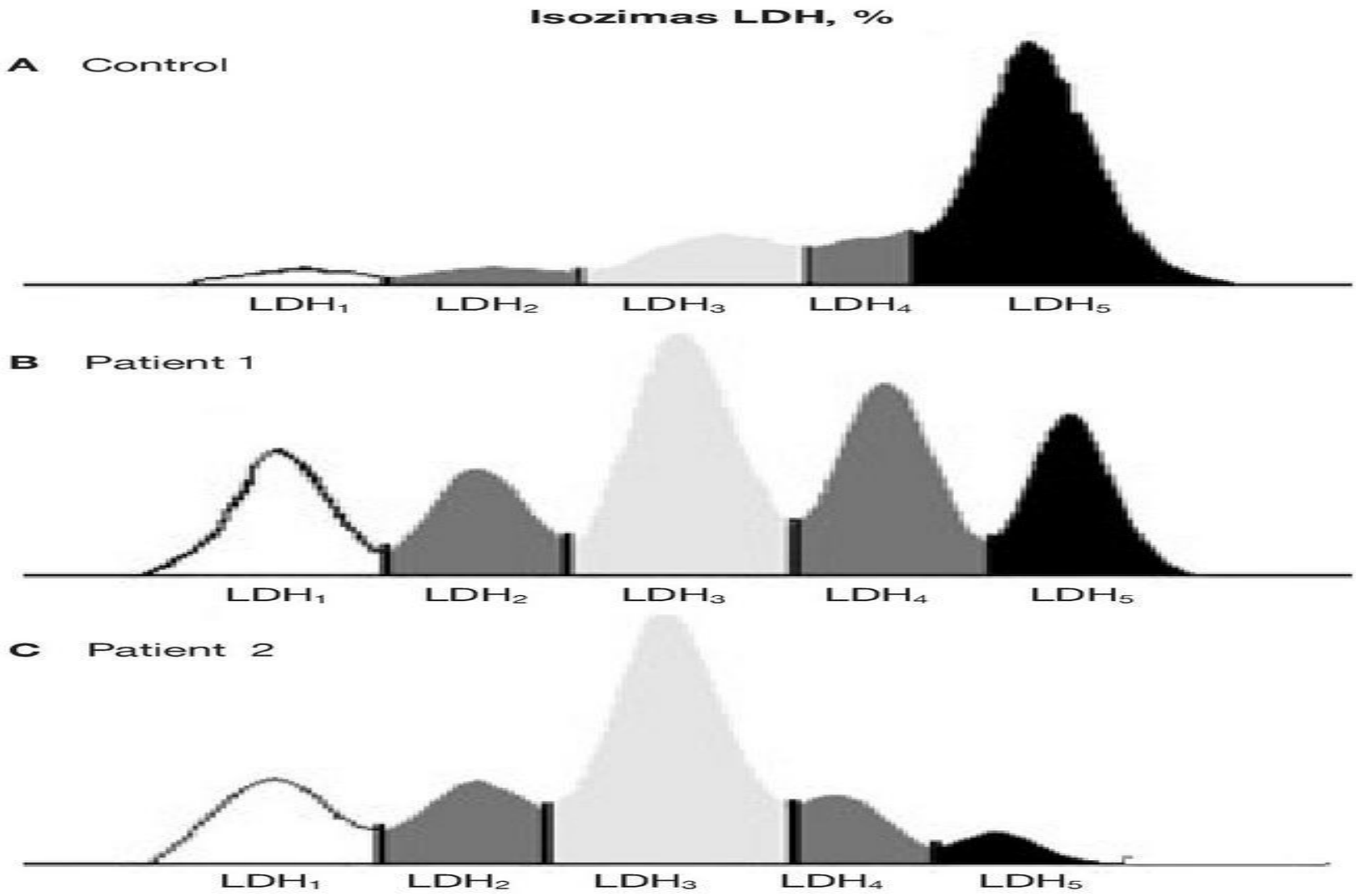
The diagram detailing patterns of myoglobin (Myo), creatine kinase MB (CK-MB), and troponin I (TnI) results among patients with an acute coronary syndrome. Among the 25 patients with an acute coronary syndrome, 8 had normal results for the triple screen of Myo/CK-MB/TnI; all but one of these patients had a positive ischemia-modified albumin test. Numbers of patients represented in the diagram are as follows: Myo/TnI+ and CK-MB/TnI, 1 each; Myo alone+, 5; Myo/CK-MB+, 3; all 3 assays+, 7.


Myoglobin
Total CK
CK-MB
LDH
Troponin I
x Upper limit of normal
7
6
5
4
3
2
0
20
40
60
80
100
12
140
160
Hours from onset of infarction



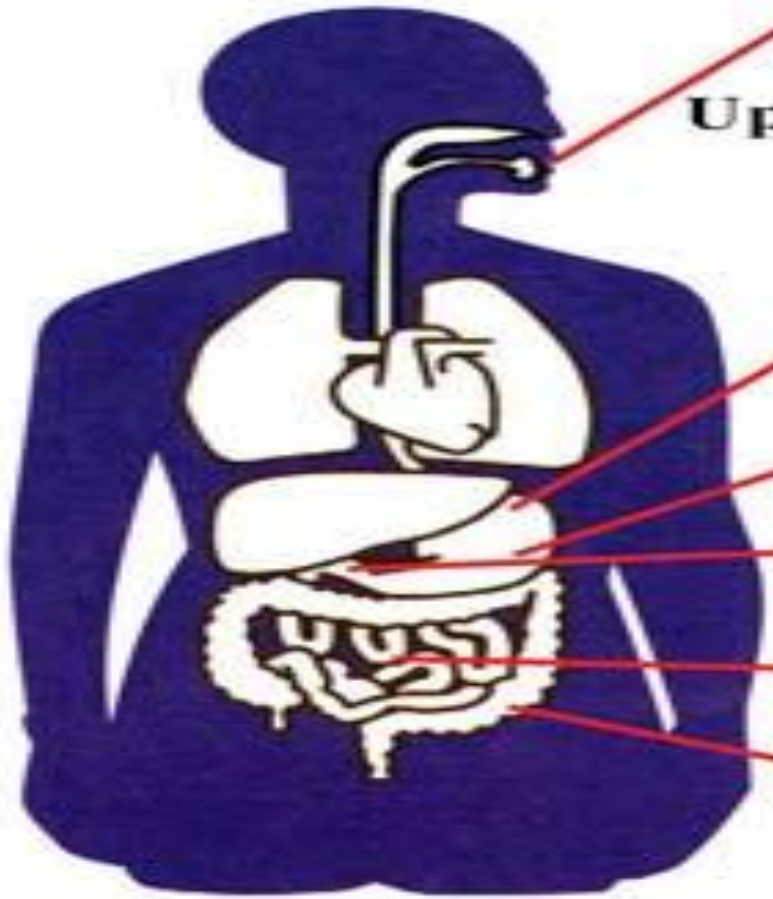
Creatine kinase isoenzyme gel of muscle homogenates

Lane 1, control muscle expresses the MM homodimer of CK; *lane 2*, M-CK KO does not express any cytosolic CK; *lane 3*, transgenic muscle expresses the MM and BB homodimers as well as the muscle-brain heterodimer (*MB*); *lane 4*, switch muscle expresses only the BB homodimer.



Profile of the lactate dehydrogenase (LDH) isozymes in agarose gel: healthy individual (panel A) and 2 patients with profiles differing from that of controls (panel B and panel C).

The Human Digestive Tract pH Range Chart



Saliva
6.5 - 7.5 pH
up to 1 minute

Upper Stomach (fundie)
4.0 - 6.5 pH
30 - 60 minutes

Lower Stomach
1.5 - 4.0 pH
1 - 3 hours

Duodenum
7.0 - 8.5 pH
30 - 60 minutes

Small Intestine
4.0 - 7.0 pH
1 - 5 hours

Large Intestine
4.0 - 7.0 pH
10 hours - Several days

The diagram illustrates the average time food spends in each part of the digestive system along with the average pH.

ALT and **AST** are enzymes made in the liver. They are also known as transaminases. The liver uses these enzymes to metabolize amino acids and to make proteins. When liver cells are damaged or dying, ALT and AST leak into the bloodstream. Many different things can cause liver enzymes to rise above normal levels, including:

- Viral hepatitis
- Excessive alcohol intake/Alcoholic liver disease
- Liver inflammation from medications and certain herbs,
- Auto-immune hepatitis - a condition where a person's immune system mistakes the liver for an invader and attacks it,
- Fatty liver- fat build -up in liver cells, called steatohepatitis when the fatty liver is inflamed
- Inherited liver diseases
- Liver tumors
- Heart failure

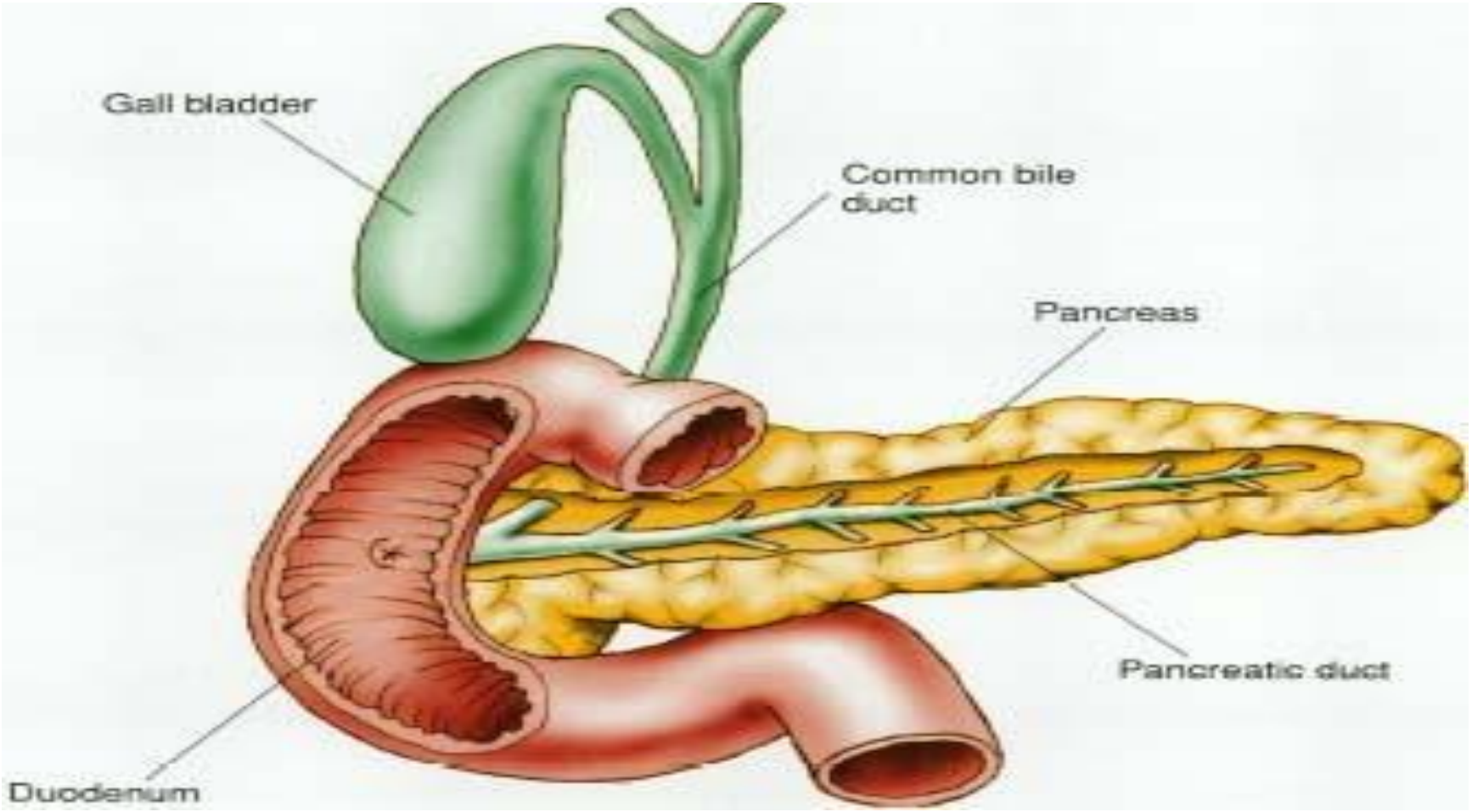
ALT (also called alanine aminotransferase or SGPT) is found in the liver only. High levels of ALT in the bloodstream mean that there may be liver inflammation and/or damage. This test cannot predict liver damage or disease progression. It is simply a direct measurement of the amount of ALT in the person's bloodstream at the time of the test. The normal range of ALT levels is between 5 IU/L to 60 IU/L (International Units per Liter). ALT levels in people with HCV often rise and fall over time, so additional testing such as HCV RNA, HCV genotyping and a liver biopsy may be needed to help determine the cause and extent of liver damage.

AST (also called aspartate aminotransferase or SGOT) is found in other organs besides the liver. High AST levels in the bloodstream can be a sign of liver trouble. AST testing measures the level of AST in a person's bloodstream at a given time. The normal range for AST levels in the bloodstream are 5 IU/L to 43 IU/L. Like ALT levels, AST levels in people with HCV often vary over time and can't be used to forecast disease progression or specifically measure liver damage.

GGT and **ALP** are also called cholestatic liver enzymes. Chloestasis is a term used for partial or full blockage of the bile ducts. Bile ducts bring bile from the liver into the gallbladder and the intestines. Bile is a green fluid produced in liver cells. Bile helps the body to break down fat, process cholesterol and get rid of toxins. If the bile duct is inflamed or damaged, GGT and ALP can get backed up and spill out from the liver into the bloodstream.

GGT (gamma-glutamyltranspeptidase) is found in the liver. Obesity, PBC, heavy drinking, fatty liver, and certain medications or herbs that are toxic to the liver can cause GGT levels to rise the normal range of GGT is from 5 IU/L to 80 IU/L.

Pancreatic Enzymes



Assay of serum :

1- Amylase (AMY)

2- Lipase (LPS)

3- Trypsin (TRY)

4- Chemotrypsin

5- Elastase 1 (E1)

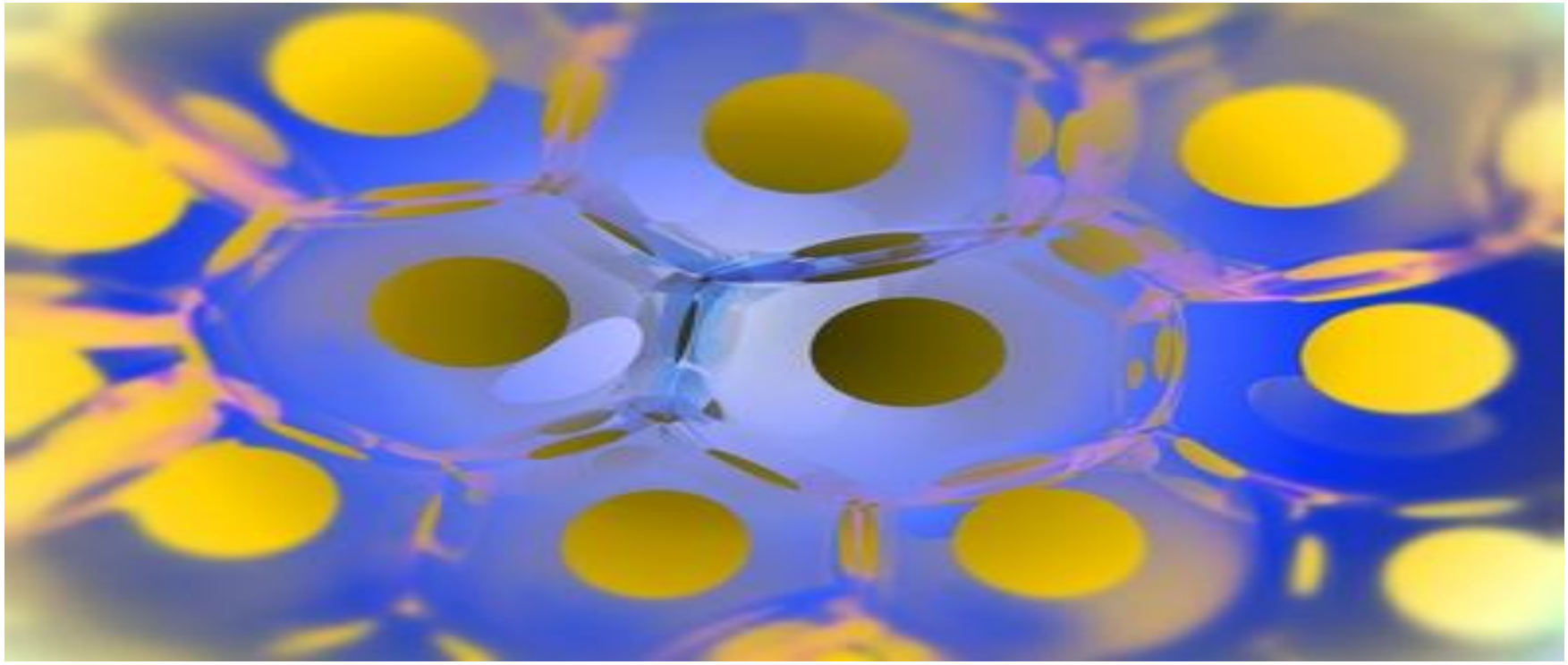
- **Protealytic enzymes have been found to increase the immune system's macrophage (white blood cell) activity by up to 700% and...**

- **Increase T-cell (cancer fighting cell) production and activity by as much as 1300% within a very short period of time after ingestion!**

Amylase: Breaks down starch "-1,4 glucan bonds". Breaks down carbohydrates, starches, and sugars that are prevalent in potatoes, fruits, vegetables, and snack foods.

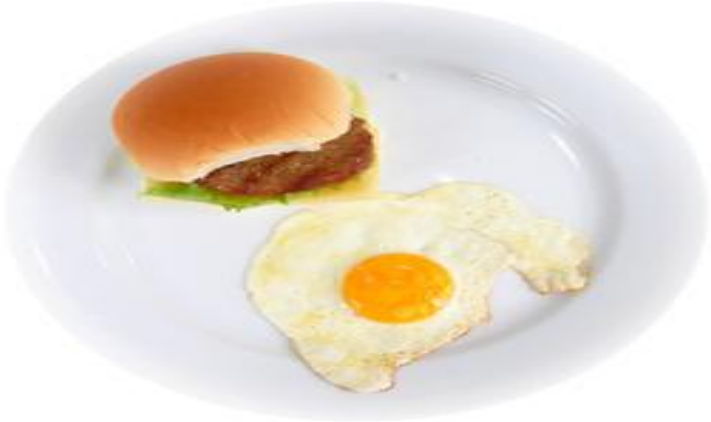
Lipase: Breaks down fats (triglycerides and other lipids) and oils. Useful in aiding in weight control, maintaining and enhancing cardiovascular health, and may help maintain proper gall bladder function.

An enzyme called *hormone-sensitive lipase* responds to the *glucagon* by causing fat cells to release fatty acids, or fats, into the bloodstream. This gives most body cells access to fat, which is a valuable source of *energy*



There are no human enzymes that are specifically designed to break down fat cells; instead, the process is a complicated one and involves many different enzymes. **Humans store fat for energy and break it down only when they are at an energy** deficit. In other words, the enzymes responsible for breaking down fat cells and their components come into play during periods of hunger or fasting.

While humans take in fat in many different forms in food, the fat must be digested before cells in the small intestine can absorb it into the bloodstream.



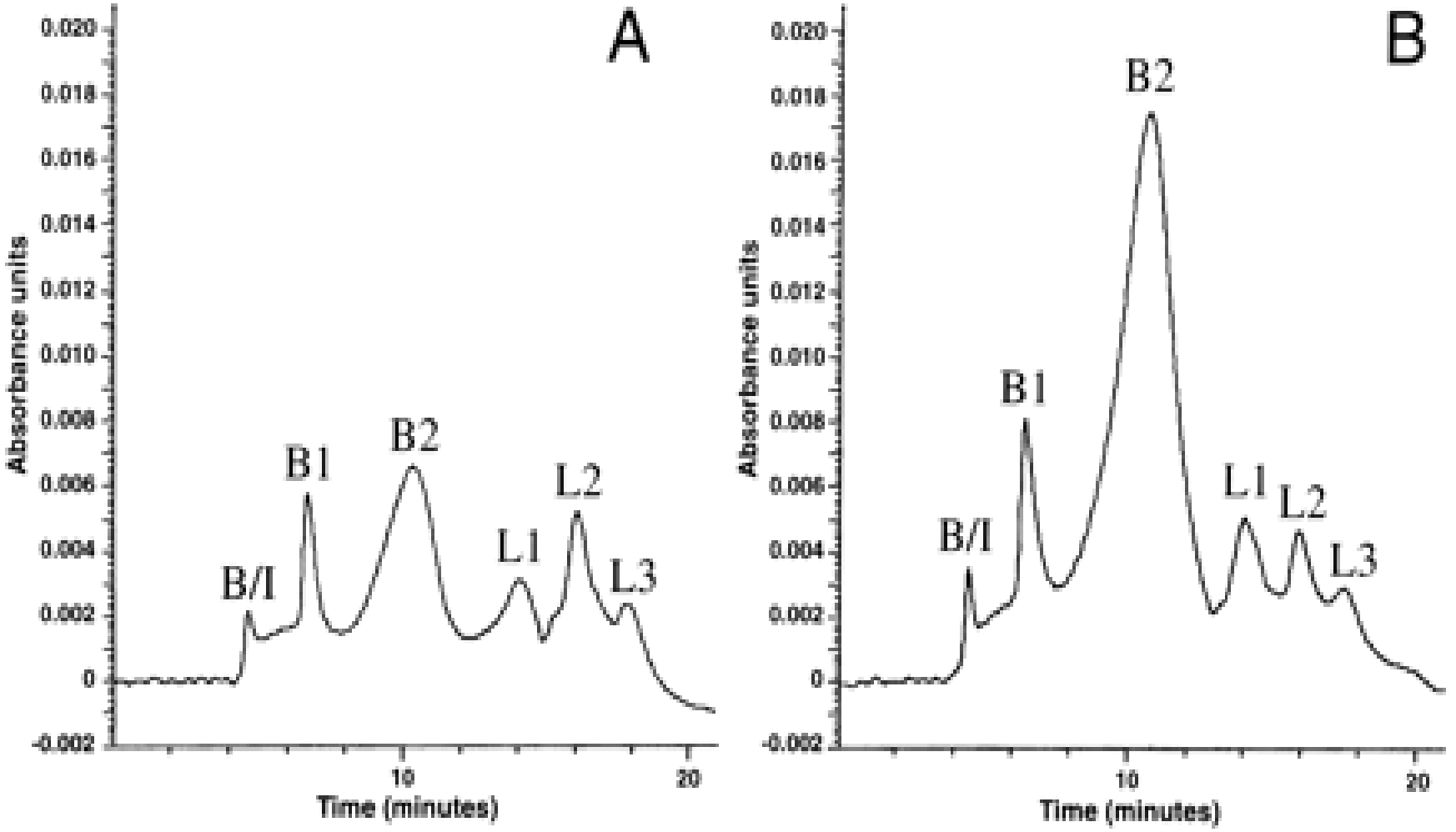
The overall purpose of lipid digestion is to modify fats chemically, essentially **breaking** large molecules into smaller ones that can easily pass through the cellular lining of the small intestine into the bloodstream. Once fat has been absorbed, it can be chemically burned, or reassembled into larger fat molecules -- called **triglycerides** -- and stored for later use in fat cells, or adipocytes. Dietary fats come in the form of either animal fats or animal and plant oils, and are common in the diet.

ALP (also called alkaline phosphatase) is found in the bones, intestines, kidneys and placenta as well as the liver. Abnormally high ALP can have many causes other than liver damage, including: bone disease, congestive heart failure, and hyperthyroidism. A rise in ALP levels can indicate liver trouble if GGT levels are also elevated. The normal range of ALP is from 30 IU/L to 115 IU/L.

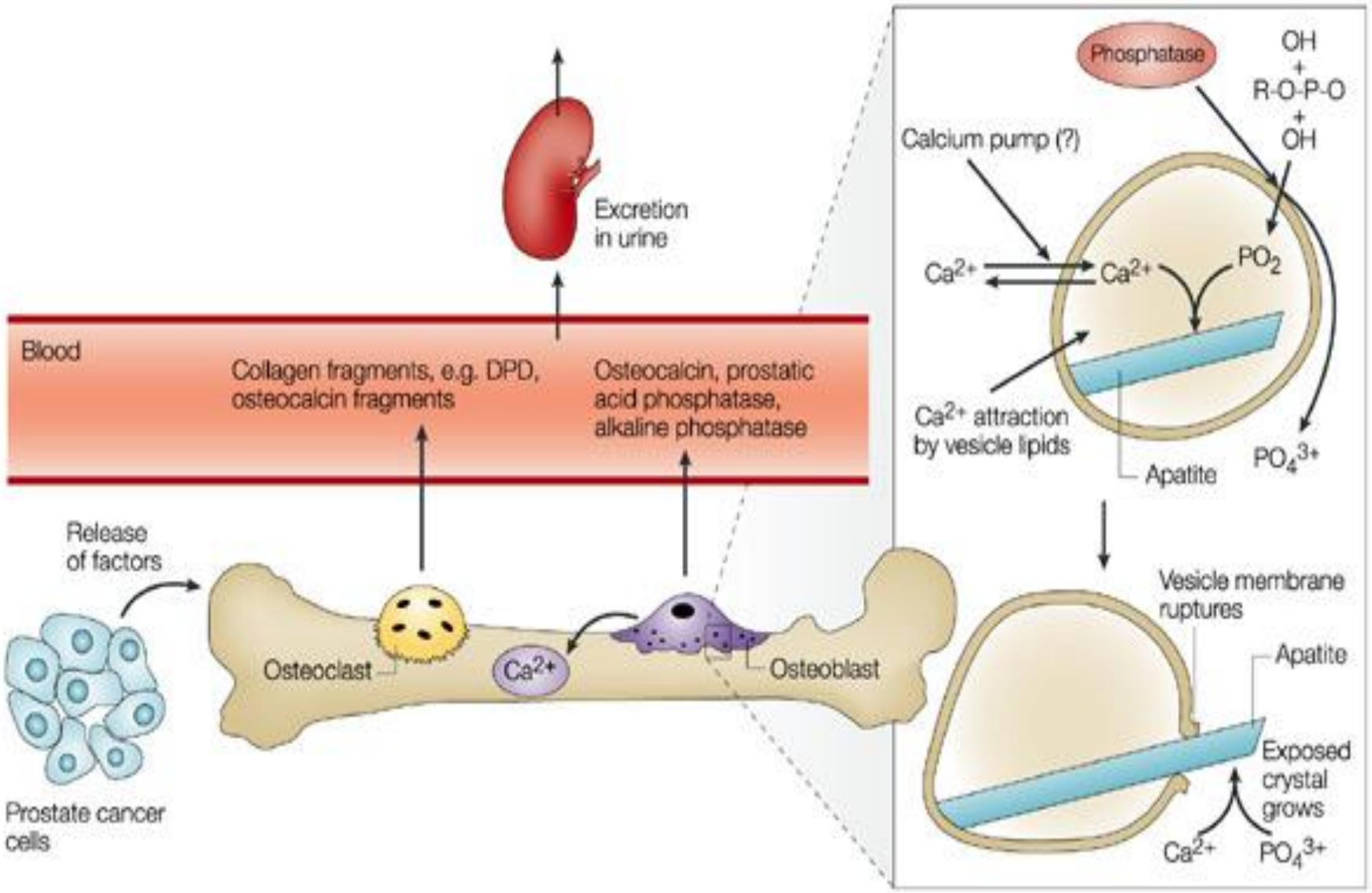
ALP metabolizes phosphorus and brings energy to the body. **GGT** brings oxygen to tissues.

Causes of elevated ALP and GGT levels include:

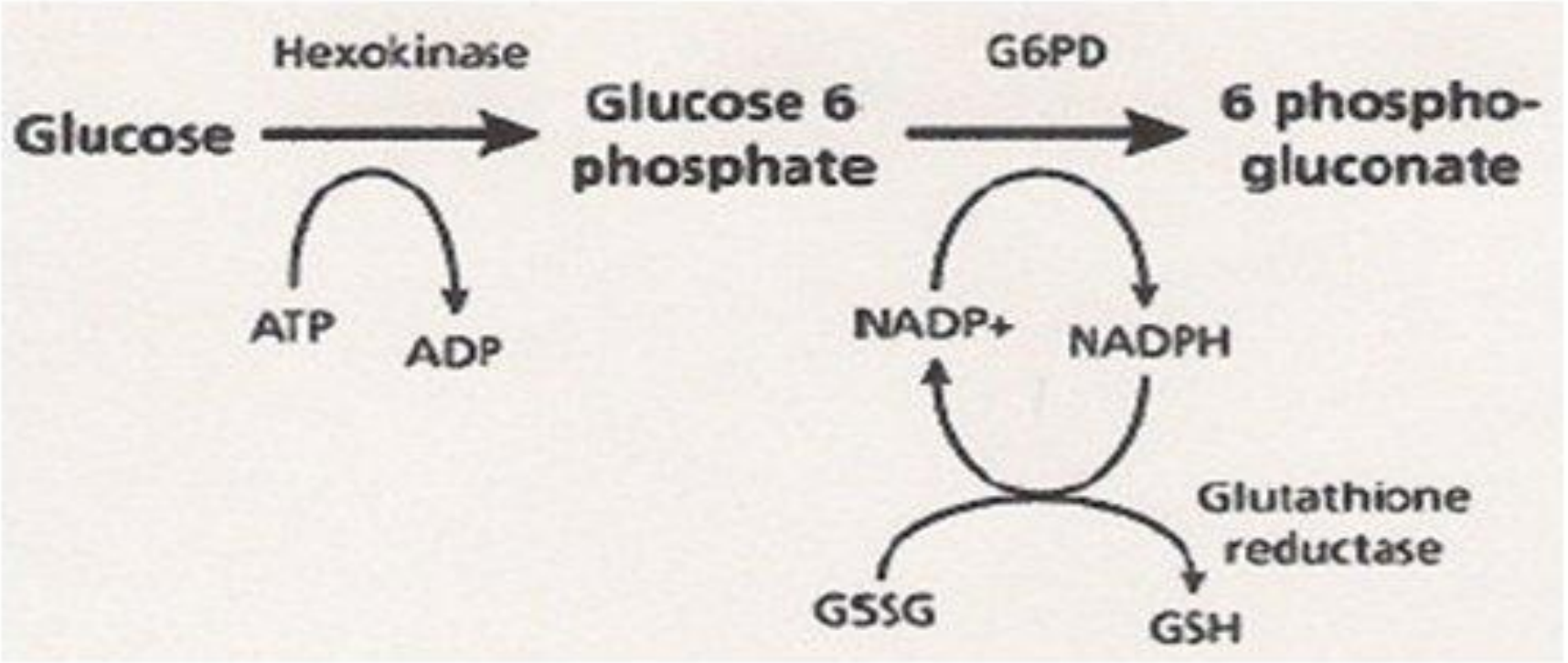
- Scarring of the bile ducts (called primary biliary cirrhosis),
- Fatty liver (steatosis),
- Alcoholic liver disease,
- Liver inflammation from medications and certain herbs,
- Liver tumors,
- Gallstones or gall bladder problems.



Serum ALP isoform profiles from a healthy male *(A)* and a prostate cancer patient with bone metastases *(B)*.



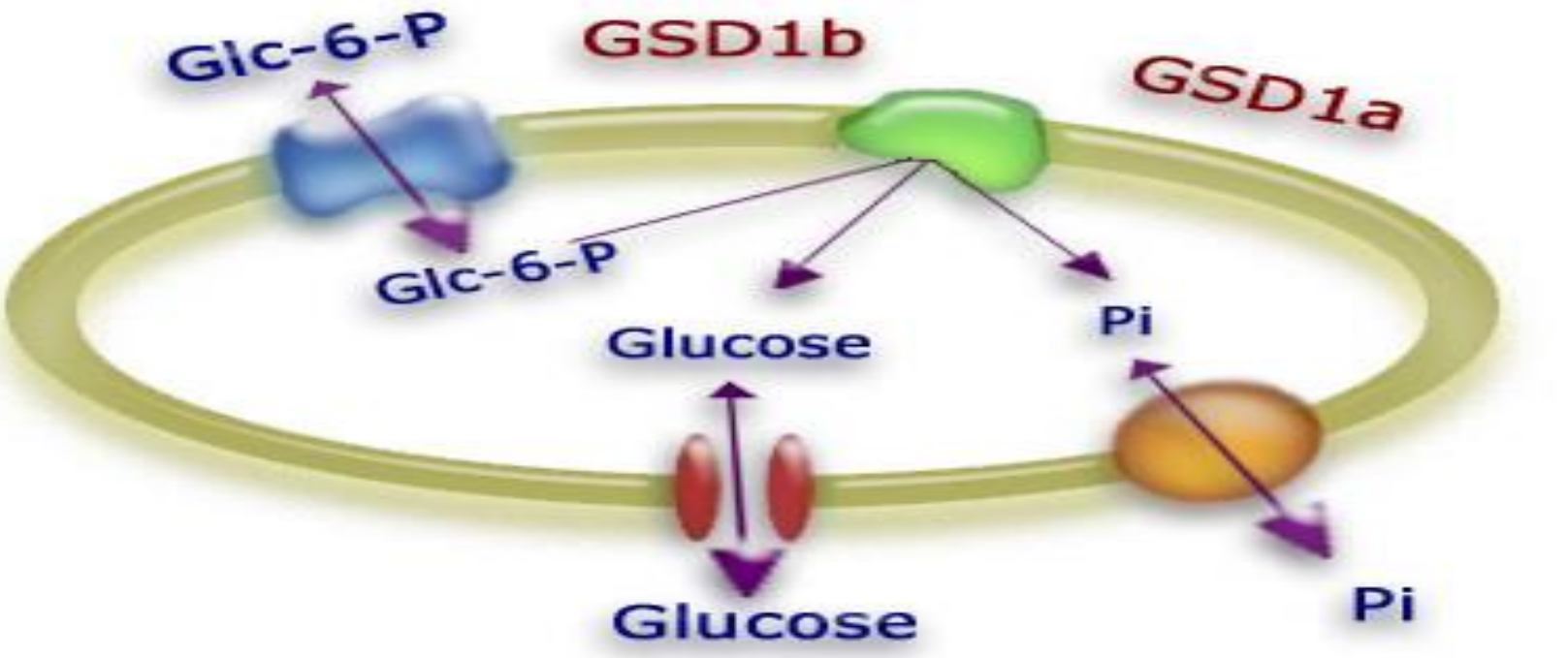
Nature Reviews | Cancer



G6PD gene is located on X-chromosome.

Reference interval in RBCs is 8-14 U/g Hb.

Values > 18 U/g Hb are often in younger than normal RBCs (as in hemolytic anemia).



Glucose-6-phosphatase is the enzyme that catalyzes the last step of glycogenolysis and gluconeogenesis in liver and kidneys, i.e. **the hydrolysis of glucose 6-phosphate to inorganic phosphate and free glucose.** Its genetic deficiency causes *glycogen storage disease type I*, a disease in which glycogen accumulation in liver and kidneys, hypoglycemia and accumulation of lactic acid in blood are observed.

Thank you