

# Biochemistry Justification



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"Special Thanks To All My Students"  
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## *Biochemistry Justification*

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# Biochemistry Justification

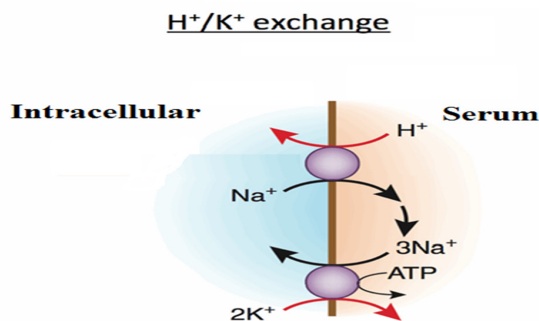
## General

### 1. Why ORS contain glucose and NaCl?

- Oral rehydration solution is used in treatment of dehydration in case of diarrhea.
- ORS contain
  - a. Sodium chloride
  - b. Sodium citrate
  - c. Glucose
- There is lots of amount of water as well as sodium loss in case of diarrhea.
- So, to correct dehydration, water is there with ORS.
- As Glucose and Sodium get absorb by symport (co-transport) mechanism, there is always, glucose is needed for sodium absorption .

### 2. Hyperkalemia can occur in Metabolic acidosis.

- There is increase concentration of  $H^+$  in Metabolic acidosis
- More potassium ions moves from intracellular to extracellular( into serum),due to high  $H^+$  concentration,



### 3. Blood Buffers act quickly but not permanently.

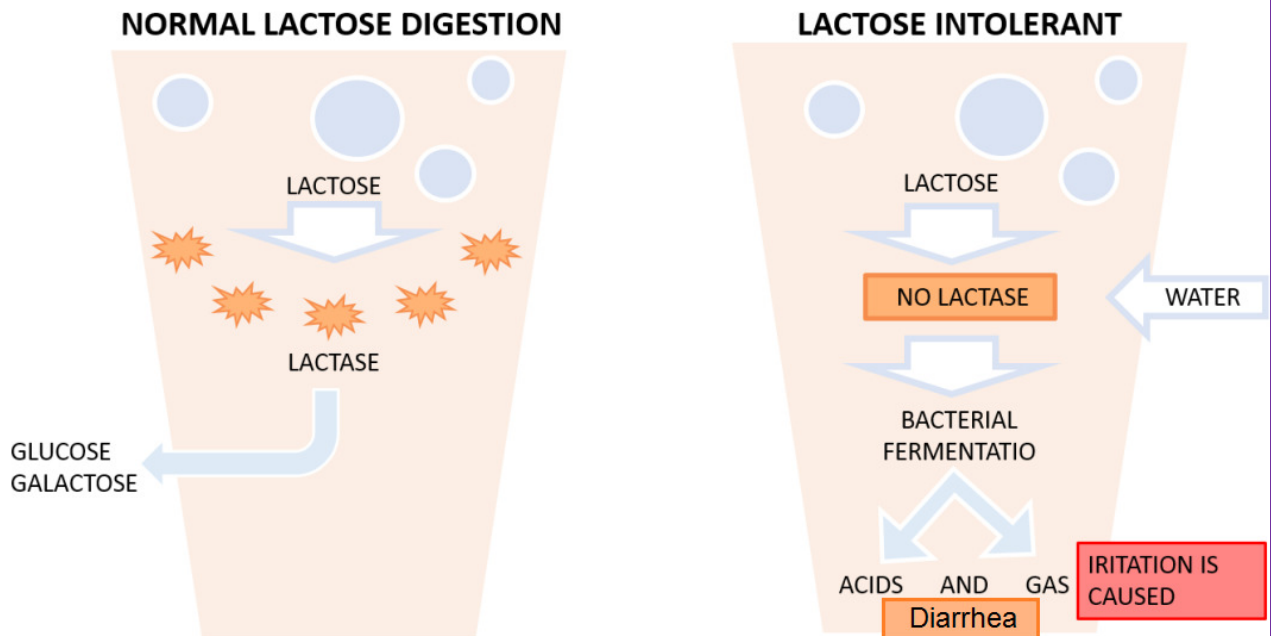
- There is three buffering mechanism for acid base balance.
  - a. Blood buffer
  - b. Respiratory mechanism
  - c. Renal Mechanism
- In blood buffer, Bicarbonate buffer ( $H_2CO_3/NaHCO_3$ ) is in ratio of 1:20
- Hence, It is having highest capacity to neutralized  $H^+$  ions.
- As well as , it immediately balance acid and base.
- $CO_2$  excretion though Respiratory mechanism and  $H^+$  excretion though Renal mechanism require sometime.
- So Respiratory and renal mechanism is delayed mechanism but excrete acid permanently from blood .
- Means, Blood Buffers act quickly but not permanently.

# Biochemistry Justification

## Carbohydrate

### 4. Lactase enzyme deficiency causes diarrhea after milk ingestion.

- Lactose found in milk and dairy products.
- Lactase, an enzyme in the small intestine, is needed to break down lactose into glucose & galactose, as well as for complete digestion and absorption of lactose.
- If lactase is deficient, Lactose remains accumulate in intestine
- Because of osmotic property of lactose, it draws the water from intracellular space to intestinal lumen.
- Accumulate lactose also makes fermentation and produces gas in intestine
- Both of above mechanism causes diarrhea, abdominal discomfort and flatulence.



### 5. Glycerol is used in enema.

- Glycerol is alcohol of glyceraldehyde.
- It has same properties like carbohydrate.
- It is also very highly osmotically active substance.
- So when it is given orally or per rectally, it pulls water into the lumen of the intestine from intravascular & intracellular space.
- That increases the water content of stool and makes easy defecation.
- So Glycerol is used in enema.

## Biochemistry Justification

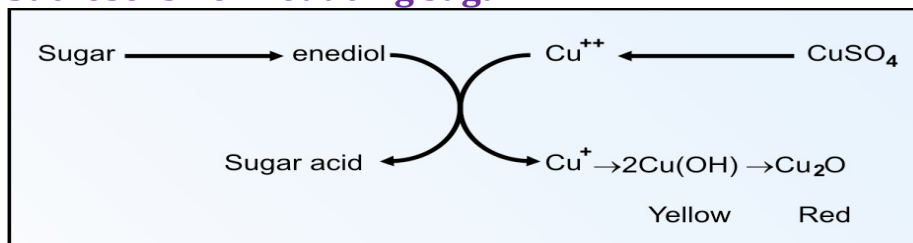
### 6. Acarbose is used in treatment of diabetes mellitus?

- Acarbose is structurally analogous to starch.
- So it inhibits action of amylase.
- So decrease breakdown & digestion of carbohydrate.
- So less amount of glucose gets released and less gets absorbed from intestine.
- Which helps to keep glucose level low.
- So Acarbose is used in treatment of diabetes mellitus.

### 7. Structure of proteoglycan is well suited for its function.

- Proteoglycans are made up of uronic acid and amine sugar with sulfate.
- Because of amine group and sulfate, they become charged molecules.
- Because of that charge, it can attract more amount of water.
- So it can keep medium spongy as well as like jelly.
- So it can absorb shocks and can work as a lubricant.

### 8. Sucrose is a non-reducing sugar



- Sucrose is made of Glucose and Fructose with  $\alpha$ -1-2 glycosidic linkage.
- Aldose, functional group of Glucose is at 1st carbon.
- Keto, functional group of fructose is at 2nd carbon.
- But functional groups are involved in  $\alpha$ -1-2 glycosidic.
- So no functional group is free to form enediol.
- No reduction of copper sulfate.
- Negative Benedict's test.
- So "Sucrose is called a non-reducing sugar."

### 9. Sucrose is an invert sugar

- Sucrose ( $+66.5^\circ$ ) = Glucose ( $+52.5^\circ$ ) + Fructose ( $-92^\circ$ )
- Sucrose is dextro-rotatory.
- While sucrose gets hydrolyzed, fructose gives more levo-rotation than glucose dextro-rotation.
- So after hydrolysis of sucrose becomes levorotatory.
- So there is a change in rotation from dextro to levo.
- So sucrose is called an invert sugar.

## *Biochemistry Justification*

### **10. Dextran is use as plasma volume expander**

- It is a complex branched polysaccharide of glucose of varying lengths, with high molecular weight.
- Because of complex structure , it can not be broken down.
- But it can give it's osmotic properties in intravascular space.
- Pull more water into intravascular space and keep it there for longer time.
- It increases blood volume and reducing its viscosity
- thus it used as plasma expander.

### **11. In acute myocardial infarction,there is elevation of lactic acid in cardiac myocyte.**

- Myocardial infarction is complete occlusion of coronary artery due to thrombose formation.
- That decreases blood supply as well as oxygen supply to myocardium.
- In absence of oxygen, these myocardium does anaerobic glycolysis for energy purpose.
- There anaerobic glycolysis convert all pyruvate to lactic acid.

### **12. Human can not digest cellulose.**

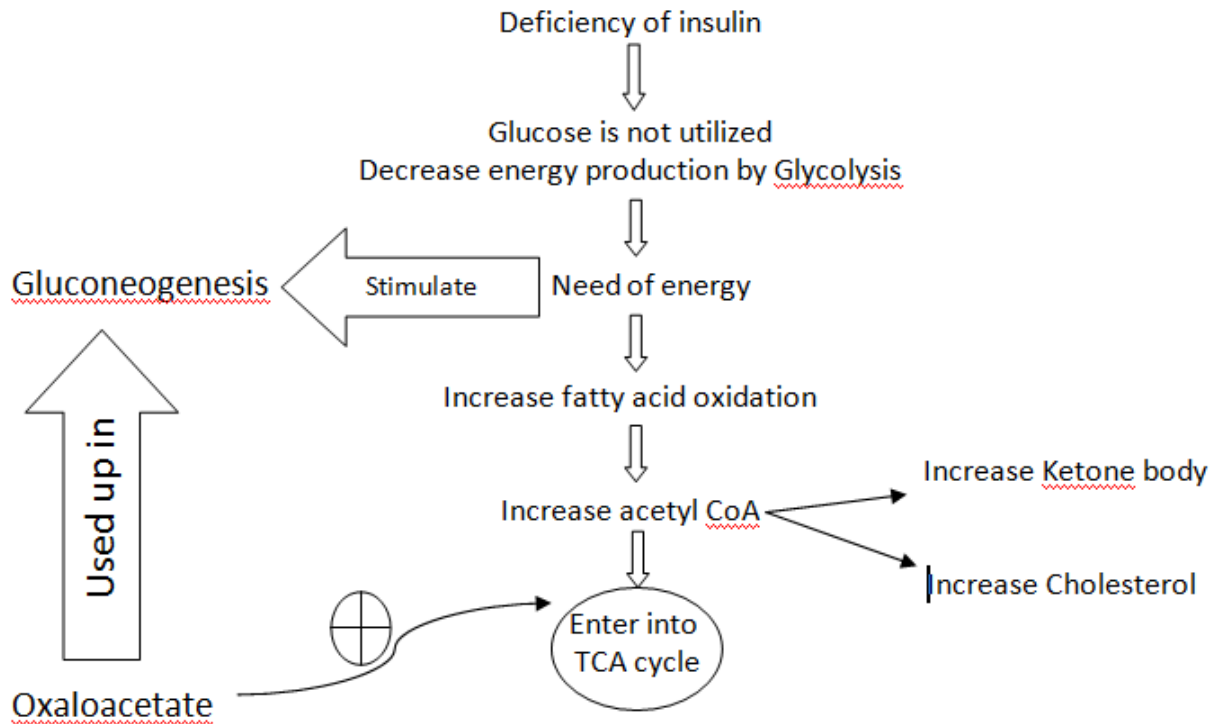
- Cellulose has beta 1-4 glycosidic linkage ( cellobiose bridge )
- Human Amylase can break only
  - alpha 1-4 glycosidic linkage.
  - alpha 1-6 glycosidic linkage.
- Human has deficiency of enzyme for beta 1-4 linkage. (Cellulobiase)
- Therefore humans can not digest cellulose

### **13. Fluoride containing vial is use for collecting blood for blood sugar estimation.**

- Collected blood sample has RBC,WBC,Platelet cells etc, which can use glucose of same sample.
- So during transportation and processing time, when sample get delay in analysis, glucose may get reduced.
- And gives false low result of blood glucose.
- In presence of fluoride, Enolase enzyme of glycolysis inhibited. So cell can not use glucose.
- That gives correct value for blood glucose
- So Fluoride containing vial is use for collecting blood for blood sugar estimation.

## Biochemistry Justification

### 14. Patient of IDDM have more risk of diabetic ketocidosis than NIDDM.



- In type II diabetes mellitus, there is increase in insulin level.
- Because of increase insulin level,
- Due to decrease sensitivity of receptors, Some of glucose may be utilized by cell.
  - Prevent Proteolysis
  - Prevent Fatty acid oxidation.
  - Less Acetyl CoA formation
  - Less ketone body formation
- Less Chances of Diabetes Ketoacidosis

### 15. Primaquine administration in G6PD deficient patient can precipitate Hemolytic anaemia.

- Decreased activity of G6PD impairs Hexose Monophosphate (HMP) Shunt.
- Thus there is no synthesis of NADPH in RBC.
- Primaquine induce free radical (oxidative stress) in RBC.
- To overcome this oxidative stress, NADPH is required which is deficient in G6PD patients.
- That high amount of free radical make damage RBC membrane
- And induce hemolytic anaemia.



## Biochemistry Justification

### 16. Uncontrolled diabetes mellitus leads to neuropathy & retinopathy.

#### Polyol pathway

- Hyperglycemia causes increased levels of intracellular glucose in nerves.
- Extra glucose is shunted into the polyol pathway and converted to sorbitol and fructose by the enzymes aldose reductase and sorbitol dehydrogenase.
- Accumulation of sorbitol and fructose lead to reduced nerve myoinositol and structural breakdown of nerves
- It causing abnormal conduction.

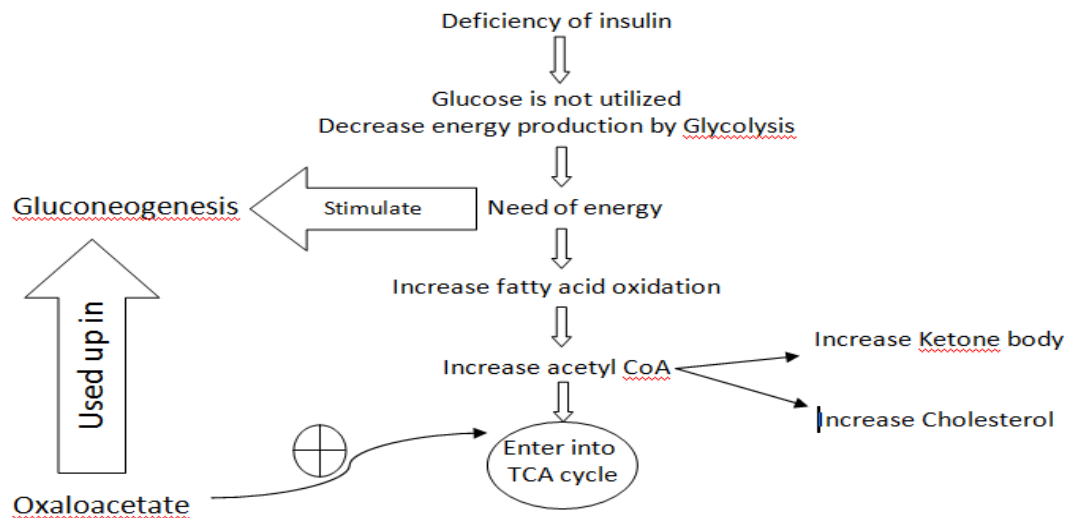
#### Advanced glycation end products

- Excess glucose makes non-enzymatic reaction with proteins, nucleotides and lipids. Which is called "Advanced Glycation End products (AGEs)".
- It may have disrupt neuronal integrity and nerve conduction.

#### Oxidative stress

- Increased production of free radicals in diabetes
- These include direct damage to blood vessels leading to nerve ischemia.

### 17. Explain Why Diabetic patients are more prone to Atherosclerotic disease.

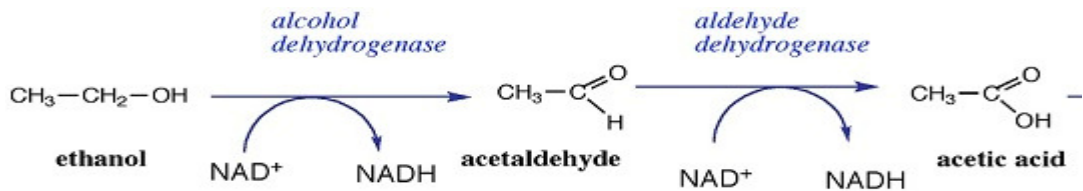


- In Uncontrolled diabetes mellitus, there is increase in insulin level.
- But glucose can not utilized by Cell, So there is
  - More Proteolysis & More Fatty acid oxidation for energy production.
- Because of more fatty acid oxidation for energy purpose, there will be more Acetyl CoA formation.
- And simultaneously, due to stimulation of gluconeogenesis process and oxaloacetate deficiency, that excess acetyl CoA can not enter into TCA cycle.
- That excess acetyl CoA make synthesis of
  - More cholesterol formation
  - More ketone body formation
- Hence, Uncontrol Diabetes mellitus , there is more chances of atherosclerosis.



## Biochemistry Justification

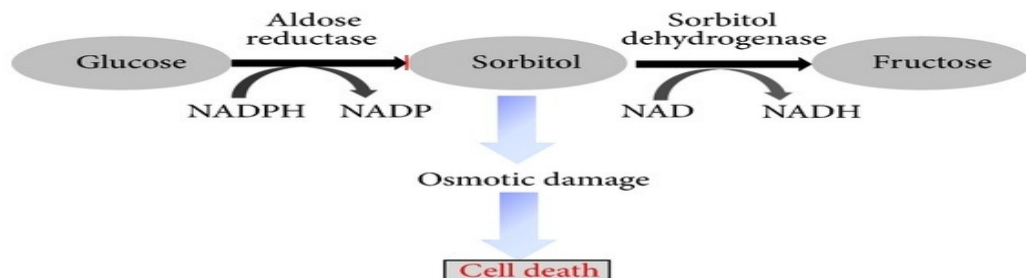
18. "Alcohol inhibit gluconeogenesis,so it causes hypoglycemia,if person is on starvation." explain it.



- Ethanol and Methanol both increase NADH:NAD ratio.
- The high concentration of NADH
  - a. Convert all pyruvate to lactate.
  - b. Inhibit TCA cycle
  - c. Decrease production of Oxaloacetate
- So, process of gluconeogenesis become slow and inhibited.

19. Cataract is more common in diabetes mellitus.

- Due to high amount of glucose
  - Increase glycation of crystalline protein of lens
  - Makes denaturation of crystalline protein of lens
  - Lens became opaque.
- In lens, kidney and nerve cell, there is deficiency of Sorbitol dehydrogenase deficiency.
  - High glucose produce high sorbitol, that sorbitol can not diffuse out of lens.
  - High sorbitol pull more water into lens and make lens swelling & opacity.

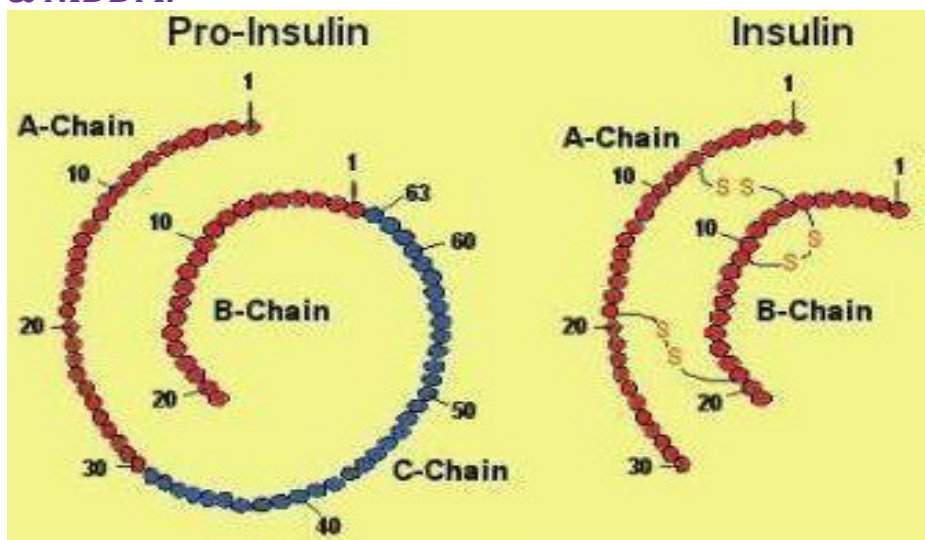


20. Hyaluronidase is called as the spreading factor.

- Hyaluronic acid is present widely throughout connective, epithelial & neural tissues.
- This hyaluronic acid acts as a cement to keep the cells together.
- Hyaluronidase is an enzyme present in various bacteria, bacteriophages, viruses, venoms of snakes etc.
- Hyaluronidase acts on hyaluronic acid and causes its breakdown.
- This helps in decreasing the viscosity and increasing the tissue permeability.
- And hence the bacteria and various toxins can migrate into the tissues and the cells and cause a condition known as cellulitis.
- So Hyaluronidase is called as the spreading factor.

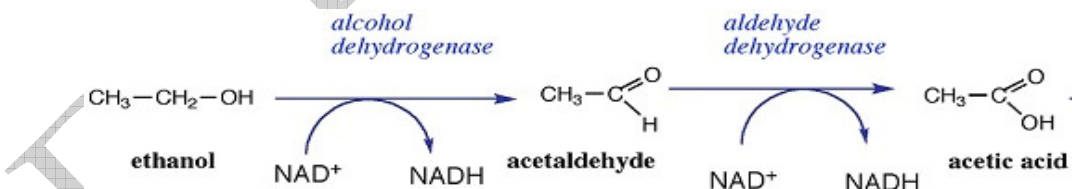
## Biochemistry Justification

### 21. Estimation of C-Peptide is better parameter to differentiate IDDM & NIDDM.



- Endogenous insulin synthesis in pre-pro-insulin form.
- Pre-pro-insulin is converted to the active insulin, simultaneously each molecular of pre-pro-insulin release connecting peptide (c-peptide).
- Endogenous Insulin & c-peptide are produced in equimolar concentration.
- So, C-Peptide level in plasma indicate endogenous production of insulin.
- IDDM= No endogenous production of insulin.
- NIDDM= Normal or Increased endogenous production insulin.
- Plasma insulin level get alter by exogenous insulin administration.
- Thus ,Very low C-peptide confirms type 1 diabetes(IDDM) & normal or high C-peptide confirms type 2 diabetes(NIDDM).
- So, C-peptide is used to differentiate IDDM &NIDDM.

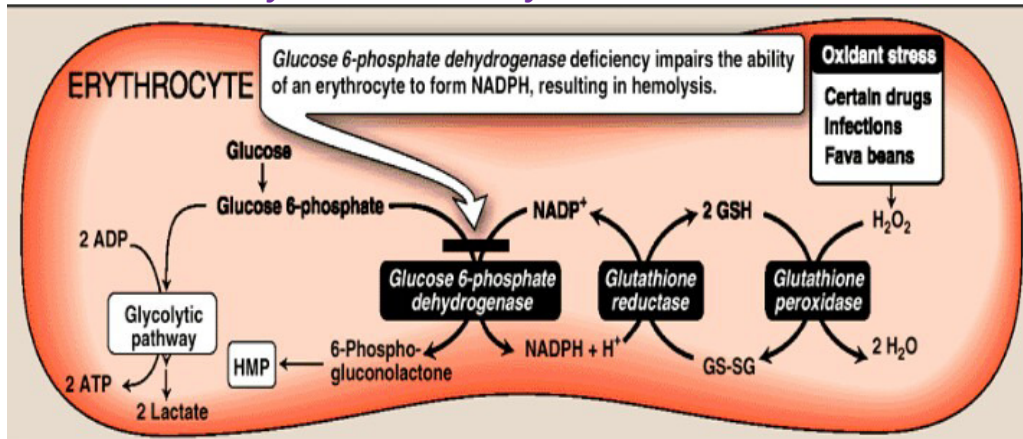
### 22. Chronic alcoholism cause gouty arthritis.



- Ethanol and Methanol both increase NADH:NAD ratio.
- The high concentration of NADH convert all pyruvate to lactate (lactic acid).
- This lactic acid compete with excretion for uric acid in renal tubule and decrease excretion of uric acid.
- That increase uric acid level and converted to uric acid crystal due acidic pH because of lactic acid.
- Hence, Chronic alcoholism cause gouty arthritis.

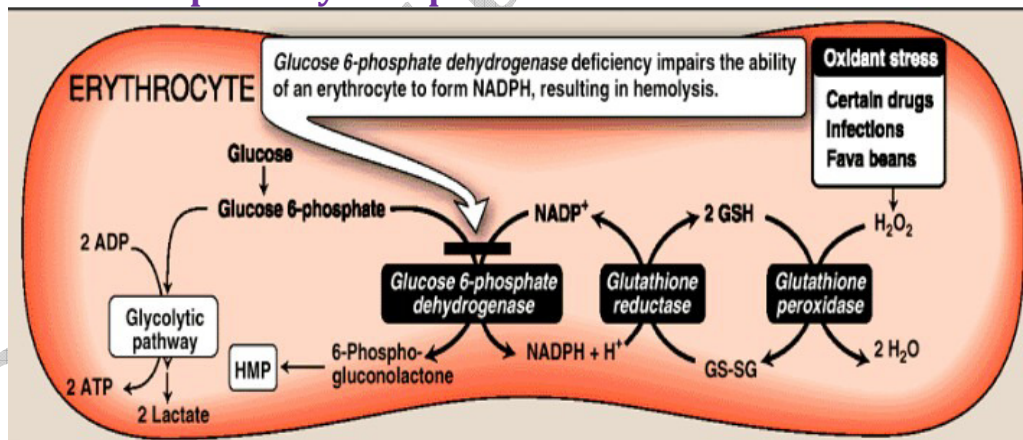
## Biochemistry Justification

### 23. G6PD deficiency causes hemolysis.



- Glucose-6-phosphate dehydrogenase (G6PD) is an enzyme in the Pentose Phosphate Pathway (HMP shunt pathway)
- This pathway provides NADPH.
- This NADPH maintains the reduced form of Glutathion (GSH) in the RBC.
- Reduced Glutathion (GSH) detoxifies peroxides & free radicals into non-toxic compounds.
- E.g. H<sub>2</sub>O<sub>2</sub> is converted to H<sub>2</sub>O
- So, G6PD deficiency impairs the ability of an erythrocyte to form NADPH, resulting in a raised level of H<sub>2</sub>O<sub>2</sub>, which causes damage to the RBC wall and leads to hemolysis.

### 24. HMP shunt pathway is important to RBCs

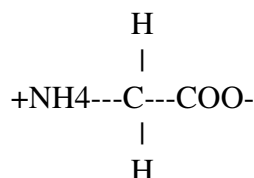


- The HMP shunt pathway makes biosynthesis of NADPH & Pentose sugar
- This NADPH maintains the reduced form of Glutathion (GSH) in the RBC.
- Reduced Glutathion (GSH) detoxifies peroxides & free radicals into non-toxic compounds.
- E.g. H<sub>2</sub>O<sub>2</sub> is converted to H<sub>2</sub>O
- So, RBC cell membrane integrity is maintained by the HMP shunt pathway and hemolysis is prevented.
- So, although no ATPs are formed in the HMP shunt pathways, it is important to RBCs.

## Biochemistry Justification

### Protein & Amino acid

#### 25. Glycine is optically inactive



- When a carbon atom bonds to 4 different group, it is called Anomeric carbon.
- All alpha amino acids has one Anomeric carbon, which provide optical activity.
- So All the amino acids has optically active.
- But Glycine has hydrogen atom as side chain.
- It means alpha carbon do not have 4 different group with it.
- So Glycine does not have anomeric carbon.
- Hence, Glycine is optically inactive.

#### 26. Peptide bond is called semi-double bond.

- When the amino group (NH<sub>4</sub><sup>+</sup>) of an amino acid combines with the carboxyl group (COO<sup>-</sup>) of another amino acid a peptide bond is formed.
- Peptide bond has rotation of 180 degree.
  - Classical Single bond=360 degree.
  - Classical Double bond=0 degree.
- Distance between two amino acid , in peptide bond is 1.32 Å
  - Classical single bond(1.42Å)
  - Classical double bond(1.27Å).
- It suggest that Peptide bond has rotation and distance more than classical double bond as well as less than classical single bond
- Hence Peptide bond is called semi-double bond.

#### 27. Zwitter ions has no mobility in electrical field.

- At isoelectric pH , Zwitter ions are form.
- It has equal number of positive and negative charges.
- But it has net charge zero
- So zwitter ion behave as neutral molecule ,when it is kept in electrical field.
- So it has no mobility in electric field.

#### 28. Lead inhibit heme synthesis.

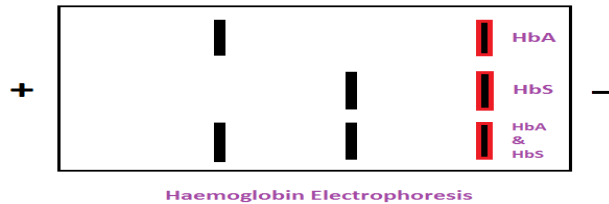
- Lead inhibit zink containing enzyme ALA dehydratase and ferrochelatase of heme synthesis.
- So, it inhibit heme synthesis.
- Means, Lead exposure can causes chronic anemia.

## Biochemistry Justification

### 29. Histidine & Arginine are semi-essential amino-acid

- Histidine and Arginine can be produced by normal hepatocyte in adulthood.
- In newborn baby and infant, because of immature hepatocyte, it can be synthesized.
- So in newborn baby and infant, it is essential in food, while in adulthood, it is not essential in food.
- So histidine & Arginine are semi-essential amino-acid

### 30. HbS move slower than HbA in alkaline gel electrophoresis.



- Gel electrophoresis is a diagnostic test in sickle cell anemia.
- In sickle cell disease, there is replacement of glutamic acid by valine.
- Negatively charged glutamic acid is replaced by a neutral charged valine.
- So HbS has less negative charge than HbA.
- Less negatively charged molecules move less in electrophoresis.
- During electrophoresis in an alkaline medium (pH 8.6), sickle cell hemoglobin moves slowly towards the anode (positive electrode) than does adult HbA.

### 31. 2,3-BPG decrease affinity of oxygen for hemoglobin.

- When 2,3-BPG binds to deoxyhemoglobin, it acts to stabilize hemoglobin in the "T state".
- It fits neatly into the cavity of the deoxy-conformation and its positive polarity is formed by salt bridges with lysine and histidine residues in the  $\beta$  subunits of hemoglobin.
- It makes it difficult for oxygen to bind to hemoglobin and more likely to be released to adjacent tissues.
- 2,3-BPG is part of a feedback mechanism to prevent tissue hypoxia, in conditions where there is a chance of tissue hypoxia.

### 32. Photosensitivity does not occur in acute intermittent porphyria.

- In acute intermittent porphyria, there is a deficiency of uroporphobilinogen synthase - I (porphobilinogen-deaminase) of heme synthesis.
- This enzyme converts porphobilinogen to hydroxymethylbilane.
- In AIP, the porphyrin precursors, porphobilinogen and amino-levulinic acid (ALA), accumulate.
- The predominant neurologic damage like peripheral and autonomic neuropathies and psychiatric manifestations occurs.



## *Biochemistry Justification*

### **33. Blue fluorescent light is useful in treatment of neonatal jaundice.**

- Blue fluorescent light penetrate the skin and that light is absorb by billirubin.
- Due to light absorption , Bilirubin is converted into two isomers.
  - Z-Bilirubin (Lumirubin , Structural isomer, Irreversible)
  - E-Bilirubin (Photobilirubin , configurational isomer, reversible)
- Both are less lipophilic than normal billirubin , without involvement of liver conjugation.
- This billirubin is excreated though bile and urine.

### **34. Zwitter ions has minimum buffering & solubility capacity.**

- Zwitter ion form of amino acid has net charge zero.
- It contain equal number of positive & negative charges.
- Due to that increase attraction between the each molecule and increase chances of precipitation formation.
- So it is less soluble.
- Due to zero net charge, it can neutralized less acid and base.
- So , it is less buffering capacity.

### **35. Row egg is use in treatment of metal poisoning.**

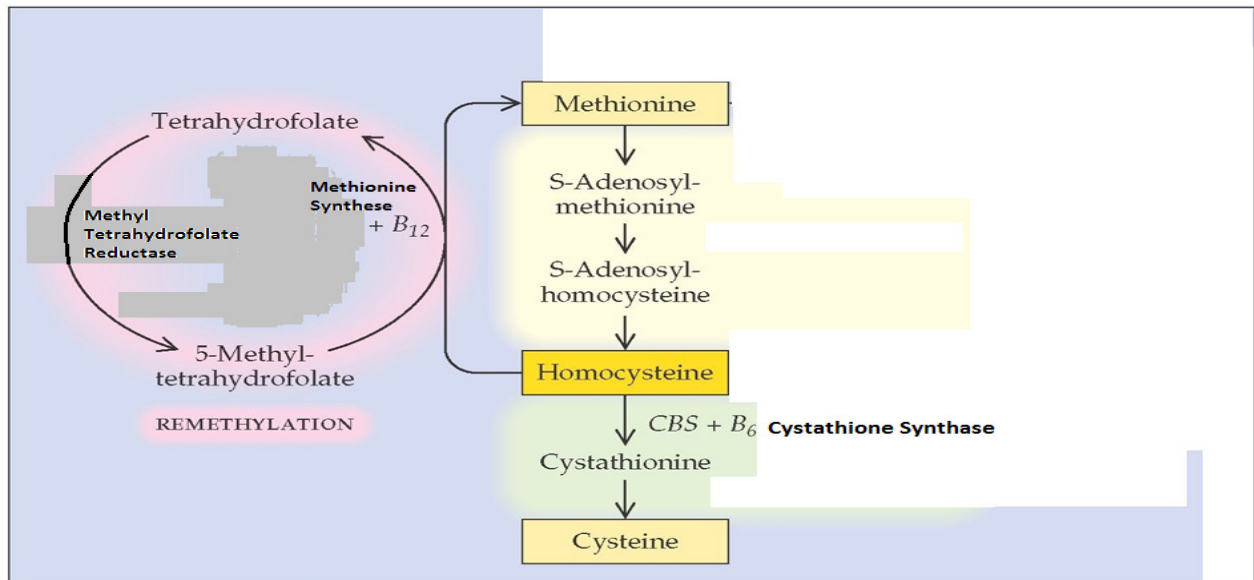
- In case of Metal poisoning , Metal causes denaturation of protein of the gastro-intestinal cells.
- Damage mucosa and get absorb.
- If raw egg protein precipitated by metal.
- Decrease damage to gastro-intestinal mucosa as well as it absorption.
- Decrease toxicity of Metal poisoning.
- So Raw egg is used in metal poisoning.

### **36. Increase level of Homocysteine increase risk of atherosclerosis**

- Interfere with lysyl residual of collegen tissue.
  - Collegen cross liking is affected.
  - Collegen tissue of blood vessels are damage easily
- Homocysteine thiolectone is a highly reactive free radical
  - which thiolate LDL
  - Increase oxidized LDL
  - Increase tendency for atherosclerosis.
- It activate Hageman's factor
  - More chance of platelet aggregation.
- This action of homocystein increase risk of atherosclerosis..

## Biochemistry Justification

### 37. Folic acid , vitamin B12 and pyridoxime phosphate is use to reduce homocysteine level.



- Hyperhomocysteinemia leads to vascular disease
- Vitamin B12 & Folic acid is require as co-enzyme for action of Methionine synthesis & Methyl Tetrahydrofolate Reductase enzyme.
- And convert homocysteine to methionine.
- Pyridoxime phopate (Vit-B6) is require for cystathione synthase activity.
- Which convert homocysteine into cystein.
- So Folic acid , vitamin B12 and pyridoxime phosphate is use to reduce homocysteine level

### 38. “Haemoglobin is good blood buffer”.

- Haemoglobin is present in highest concentration in blood.
- And it contain maximum amount of imidazole group containing histidine (38 residual) amino acid.
- Histidine's pk (6.8) value is very nearer to physiological pH, so it can bind more amount of H<sup>+</sup> ions.
- Deoxygenated haemoglobin can bind with H<sup>+</sup> due Haldane effect.
- Hence, “Haemoglobin is good blood buffer”

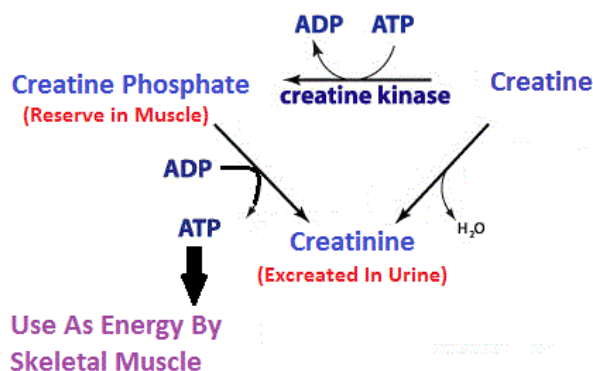
### 39. Alpha 1 anti-trypsin deficiency cause emphysema.

- Alpha 1 anti-trypsin inactivate elastase enzyme and prevent damage to elastic and collagen containing tissue like lung's alveoli.
- In it's deficiency, there is more activity of elastase enzyme.
- Lung's alveoli get damage due to over activity of elastase.
- And it causes emphysema.



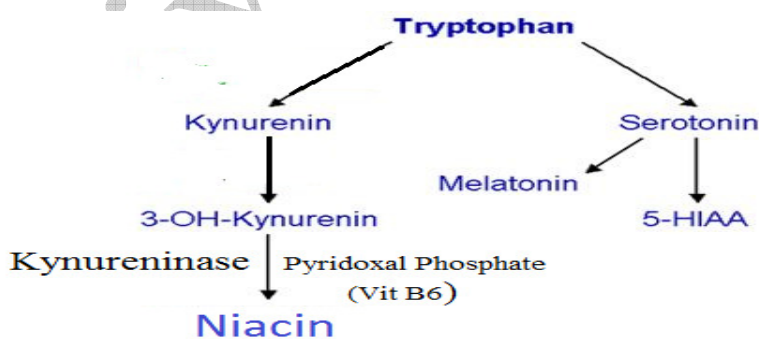
## Biochemistry Justification

### 40. Creatine is use to improve performance of athletes



- Body has several ways to convert ADP back to ATP.
- This is the fastest method is to move the phosphate group of phosphocreatine onto ADP
- This yields ATP.
- Which is immediately available for muscular work .
- There is enough phosphocreatine to keep ATP levels up for several more seconds
- If Creatine is supplied to athletes , it increase reserve store of creatine phosphate with action of enzyme creatine kinase.
- So , By this cycle, These high reserve creatine phosphate can provide immediate & fast energy in form of ATP during time of athletic performance ,for longer time.
- And Help to to improve performance of athletes.

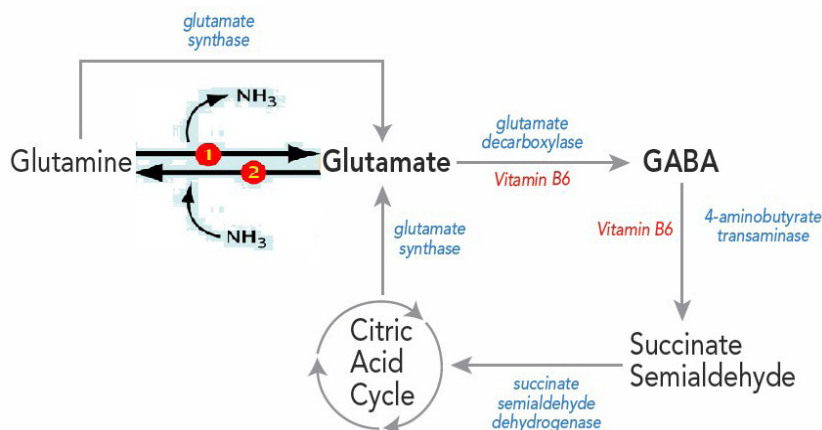
### 41. In Carcinoid syndrome, patient may suffer from pellegra.



- Carcinoid syndrome is neuroendocrine tumors of the GI tract
- In normal person, only 1% of dietary tryptophan is converted to serotonin.
- But in carcinoid syndrome, almost 60% of tryptophan used for serotonin synthesis.
- Which limits the available tryptophan for niacin synthesis.
- Which leads to decrease in conversion of tryptophan to niacin synthesis.
- Hence, deficiency of niacin leads to pellegra.

## Biochemistry Justification

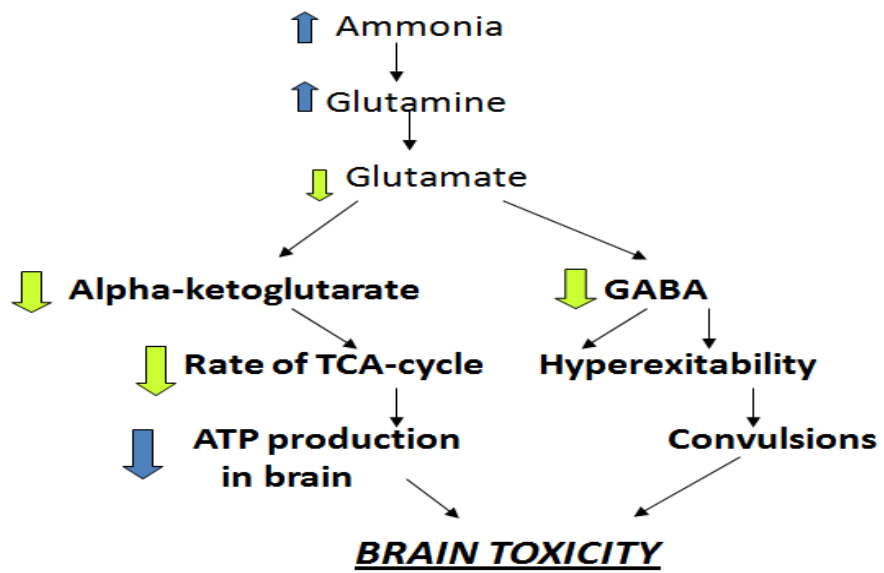
### 42. Increase ammonia is toxic to brain.



#### Mechanisms for toxicity of high Ammonia

- High  $[\text{NH}_3]$  would drive Glutamine Synthase:
  - $\text{Glutamate} + \text{NH}_3 \rightarrow \text{Glutamine}$
  - This decrease glutamate.
  - So there is decrease synthesis of inhibitory neurotransmitter GABA. That makes convulsion.
- Depletion of glutamate & high ammonia level would drive Glutamate Dehydrogenase reaction to
  - $\alpha\text{-ketoglutarate} + \text{NH}_4^+ \rightarrow \text{Glutamate}$
  - These resulting depletion of  $\alpha\text{-ketoglutarate}$ , an essential Krebs Cycle intermediate, could impair energy metabolism in the brain.
  - Which affect normal physiological brain activity.
- Due to high ammonia, conc. of Glutamine remains high in brain cell.
  - Glutamine is co-transported outside from brain cell with tryptophan influx.
  - So, More Tryptophan get accumulated in brain cell and more glutamine goes out of cell.
  - From accumulated Tryptophan, Serotonine synthesis & that have depressive effect on neurons.

## Biochemistry Justification



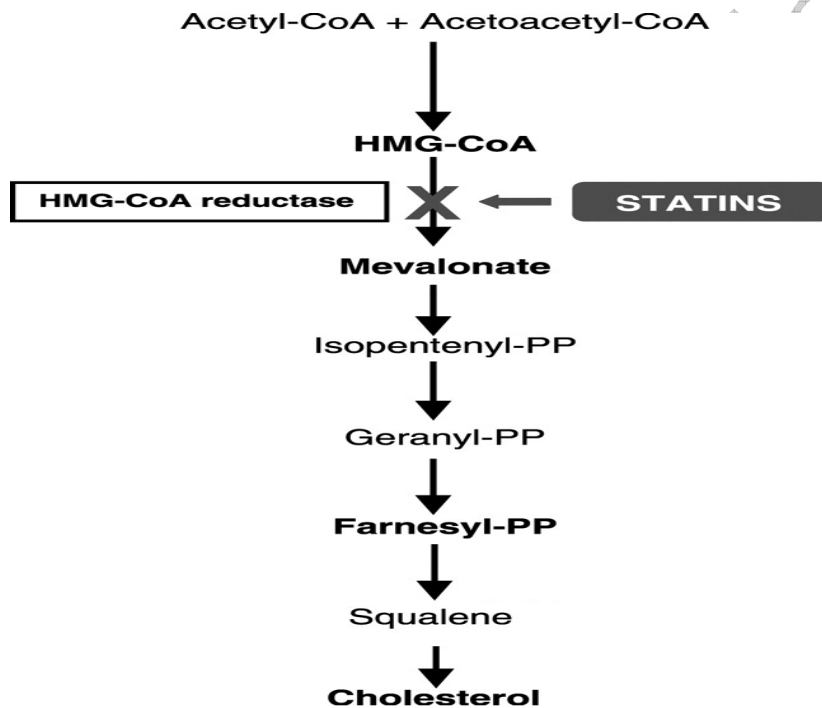
Dr Piyush

# Biochemistry Justification

## Lipid

### 43. Sudden withdrawal of Statin drugs will cause Hypercholesteremia.

- To decrease serum cholesterol level, statin drugs are used.
- Statins does competitive inhibition of HMG-CoA reductase enzyme.
- So after few month, cholesterol level decreases.
- So Concentration of HMG CoA reductase enzyme increases because of increase expression of HMG\_CoA reductase gene , through feedback mechanism.
- So if Suddenly, statin drug withdrawn, due to high level of enzyme, there will be increase production of Cholesterol.
- And it will cause Hypercholesteremia.



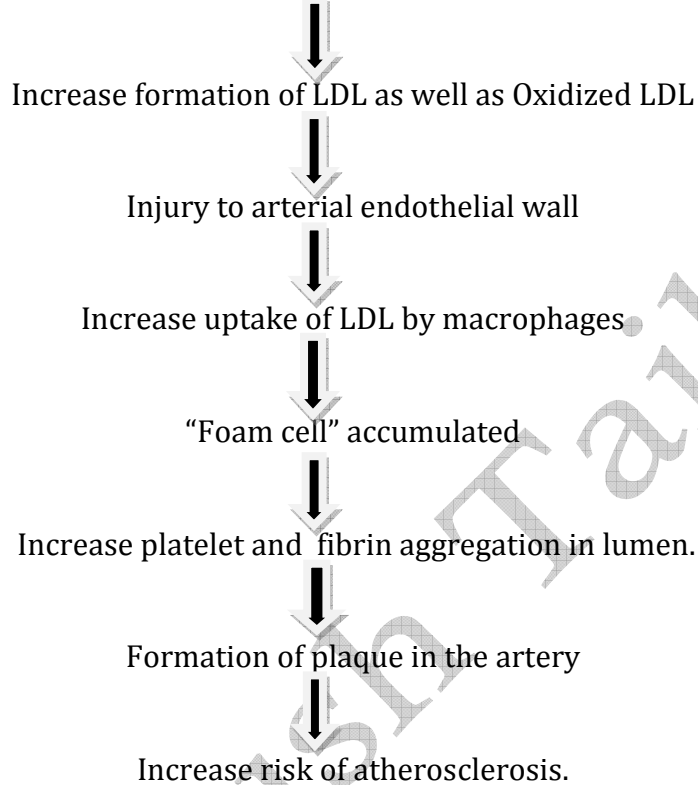
### 44. Snake bite causes severe hemolysis

- Snake venom contains hydrolase type of enzyme called phospholipase A2 (Lecithinase)
- Phospholipase A2 causes lysis of lecithine (phospholipid) of the cell membrane of RBC.
- Phospholipid (cell) → Lysolecithin + Fatty acid.
- This Lysolecithin work like surfactant.
- So RBC are damaged and leading to severe hemolysis of RBC.

## Biochemistry Justification

### 45. Rancidity increases the risk of atherosclerosis.

Rancidity leads to Formation of Trans Polyunsaturated fatty acid and Free Radical



### 46. Pancreatitis leads to steatorrhea.

- To break ester bond of triglyceride, cholesterol ester and phospholipid of food lipid (fat), lipase enzyme from pancreas require.
- In pancreatitis (inflammation of pancreas), there is decrease secretion of lipase enzyme from pancreas
- Due to deficiency of lipase enzyme, Lipid digestion remain undigested.
- That lipid droplet get emulsified because of bile (splited) but it can not be digested due to lipase deficiency.
- So Patient of pancreatitis had a split steatorrhea

### 47. Cystic fibrosis causes deficiency of lipid soluble vitamin.

- Cystic fibrosis is genetic disease due to mutation in CFTR (Cystic Fibrosis Transmembrane Regulator) gene.
- Which affect all secretory glands.
- Due to this pancreatic , gall bladder & all most all glands secret thick and sticky secretion.
- That increase chance of blockage in gland.
- Decrease Bile & Pancreatic secretion.
- Decrease digestion & absorption of fat
- Decrease digestion & absorption of fat soluble vitamins.

## Biochemistry Justification

### 48. Orlistate is use as Anti-obesity agent.

- Orlistate is an inhibitor of pancreatic and gastric lipase.
- It inhibit the active site of the lipase in GIT
- So it is preventing the absorption of fat
- And fat excreted in feces, undigested.
- So it use as anti-obesity agent.

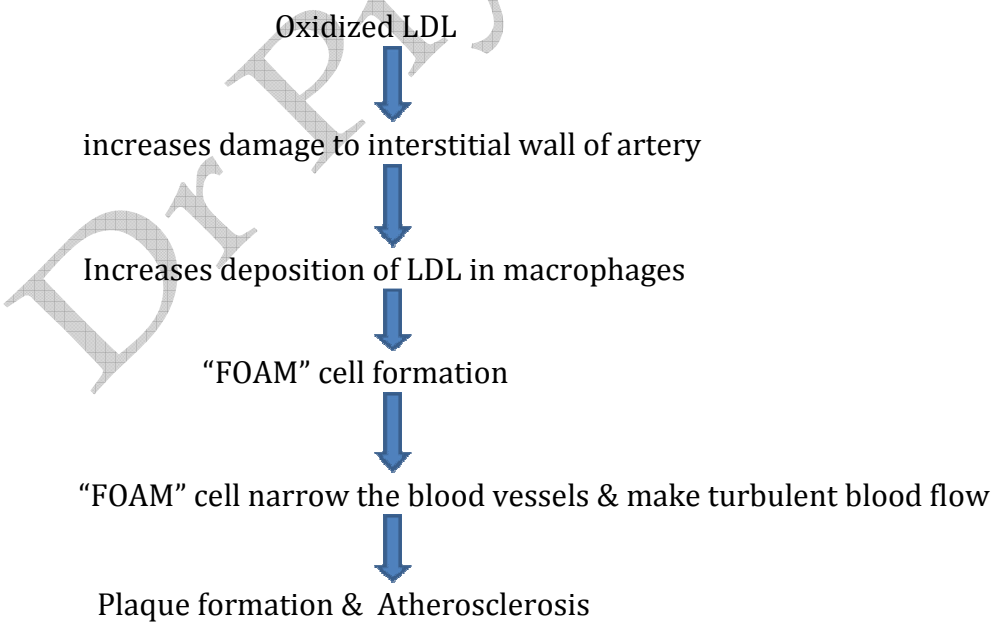
### 49. Orlistat (pancreatic and hepatic lipase inhibitor)treatment is supplemented with lipid soluble vitamins.

- Pancreatic lipases degrade dietary Triglyceride into Fatty acid & Glycerol.
- Orlistat = Pancreatic lipase inhibitor
- So no breakdown of Triglyceride
- So no absorption of fat
- Ultimatly no absorption of fat soluble vitamin ( A,D,E,K)

### 50. Sunflower oil (Omega-3 & Omega-6 fatty acid) decrease risk of atherosclerosis.

- Sunflower oil provide PUFAs .
- PUFAs and Arachidonic acid compete with cyclooxygenase enzyme.
- So There is decreases production of arachidonic acid-derived prostaglandins and leukotrienes, decreased production of inflammatory cytokines, decreased expression of adhesion molecules.
- Sunflower oil (Omega-3 & Omega-6 fatty acid) decrease risk of atherosclerosis.

### 51. Oxidized LDL is improtant in pathogenesis of atherosclerosis.



## *Biochemistry Justification*

### **52. High HDL level is decrease risk of coronary heart disease.**

- HDL has apolipoprotein A-1 which activate LCAT (Lecithin Cholesterol Acyl Transferase) enzyme.
- LCAT help in transferring fatty acid from lecithin to cholesterol.
- So there is more formation of cholesterol ester, which has hydrophobic.
- Because of it's hydrophobic property, more esterified cholesterol is internalized into HDL molecule from peripheral tissue and other lipoprotein.
- Also, HDL is very good acceptor of unesterified cholesterol.
- It suggest that HDL is collect cholesterol molecule from tissue as well as from other lipoprotein and drain to the liver.
- This decrease chance of cholesterol deposition, atherosclerosis.
- So, High HDL level is decrease risk of coronary heart disease.

### **53. Linoleic acid and linolenic acid are essential fatty acid.**

- Linoleic (18:2, Omega 6) and Linolenic acid (18:3, Omega 3) are polyunsaturated fatty acid with 2 and 3 double bond subsequently.
- Humans have carbon 9, 6, 5 and 4 desaturases, but lack the ability to introduce double bonds from carbon 10 to the  $\omega$ -end of the chain.
- This is the basis for the nutritional essentiality of the polyunsaturated linoleic and linolenic acids.
- Linoleic acid is the precursor of arachidonic acid, the substrate for prostaglandin synthesis.
- Linolenic acid, the precursor of other  $\omega$ -3 fatty acids important for growth and development.
- So, Linoleic acid and linolenic acid are essential fatty acid.

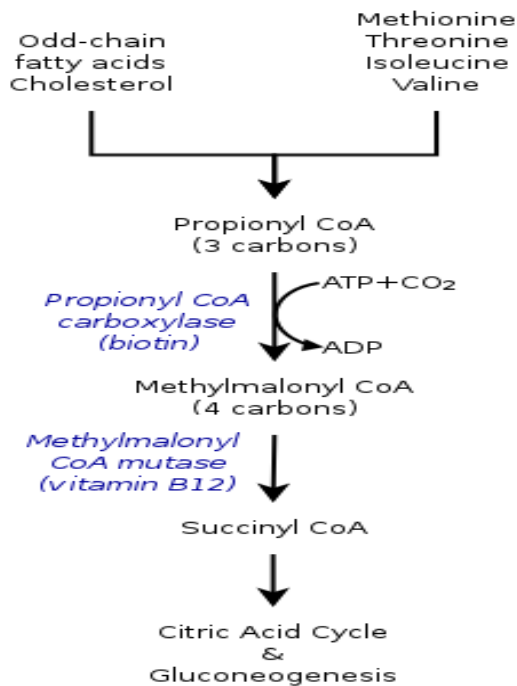
### **54. Pre-mature baby can suffer from Acute Respiratory Distress Syndrome.**

- A baby lung alveoli cell normally begins producing surfactant like dipalmitoyl phosphatidyl lecithine between 24 & 28 weeks of pregnancy.
- At 34 week of pregnancy , baby produce enough surfactant to provide normal breath and lung expansion after birth.
- If baby born prematurely, they may not have enough surfactant in their lungs alveoli.
- Because of insufficient lung surfactant in alveoli, Surface tension inside alveoli increase and make collapse of the lungs alveoli.
- Which causes Acute respiratory distress syndrome.



## Biochemistry Justification

### 55. Vitamin B12 Deficiency causes methylmalonic aciduria.



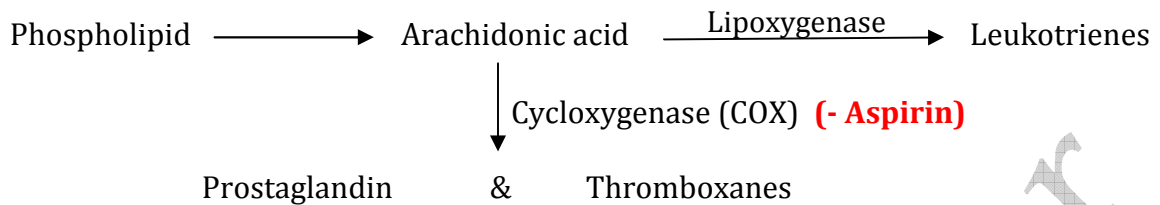
- So, in vitamin B 12 deficiency, there will be accumulation of methyl melonic acid which make neuronal damage.
- it will be excreted in urine.
- That condition is called “ Methyl Melonic aciduria”

### 56. Anti inflammatory action of aspirin is reversible , but anti platelet action is irreversible.

- Aspirin suppress the production of Prostaglandins & thromboxanes by irreversible inactivation of COX.
- Where an acetyl group is covalently attached to a serin residue in the active site of COX enzyme.
- This make aspirin different from other NSAIDs which are reversible inhibitor.
- Platelet does not have DNA.
- So it cannot synthesize new enzyme.
- So Aspirin induces a permanent & irreversible anti platelet effect.
- While Endothelial cell has nucleus & DNA
- So it can synthesize new enzyme .
- So Aspirin induces reversible anti-inflammatory effect.

## Biochemistry Justification

### 57. The inhibition of COX-1 can be overcome in endothelial cells but not in platelets while patient is taking low dose Aspirin.



- Aspirin inhibits cyclo-oxygenase enzyme.
- COX makes synthesis of Prostaglandin and thromboxane.
- If it is inhibited, PG and TBX synthesis is inhibited. Hence Aspirin is useful as anti-inflammatory and anti-platelet agent.
- But, for anti-inflammatory action, it inhibits COX enzyme of endothelial cell, which has a short life span of 1 day. So as new cell synthesis occurs, that new cell has a new COX enzyme, which overcomes the inhibition of aspirin. So anti-inflammatory action remains for a short period.
- While for anti-platelet action, aspirin acts on platelet cell's COX enzyme. Platelet cell has a life span of 5-7 days. So as anti-platelet, aspirin acts for a long time.

### 58. Bile salts are detected in the urine of obstructed jaundice.

- Obstructive jaundice occurs due to obstruction in outflow of bile secretion to duodenum from liver, through gall bladder and common bile duct.
- So there is reuptake of bile component like bilirubin as well as bile salt - bile acid in hepatic circulation.
- So, there is an increase in bilirubin and bile salts level in blood.
- This high bilirubin and bile salts are excreted in the urine.

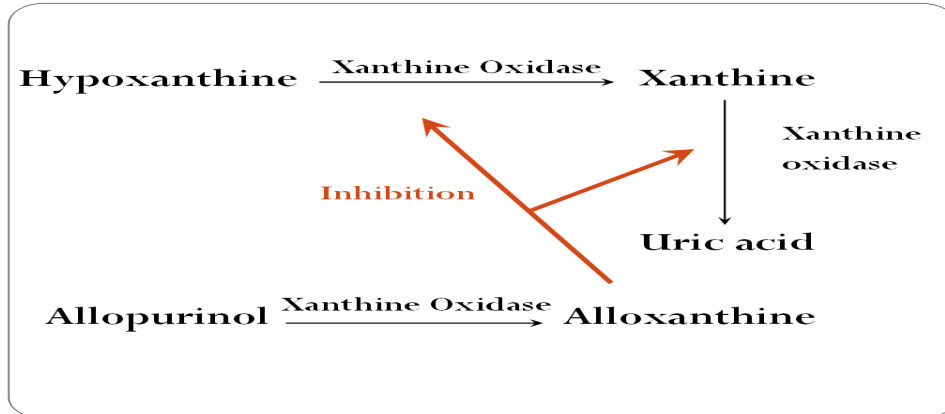
### 59. Eicosapentaenoic acid and docosahexanoic acids in food are good for health

- Eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA) are omega-3 -PUFA.
- It acts as a precursor for Eicosanoid like
  - Prostaglandin
  - Thromboxane
  - Leukotriene
- PGI<sub>2</sub> induces vasodilation & decreases inflammatory mediators
- So it can prevent atherosclerosis process as well as prevent coronary artery disease.
- EPA & DHA both are structural components of phospholipid of the cell membrane of brain cells and retina.
- It can provide better mental health
- For pregnant women, it is recommended for better development of brain cells in neonates and as well as for
- So it is considered good for cardiovascular and nervous system.

# Biochemistry Justification

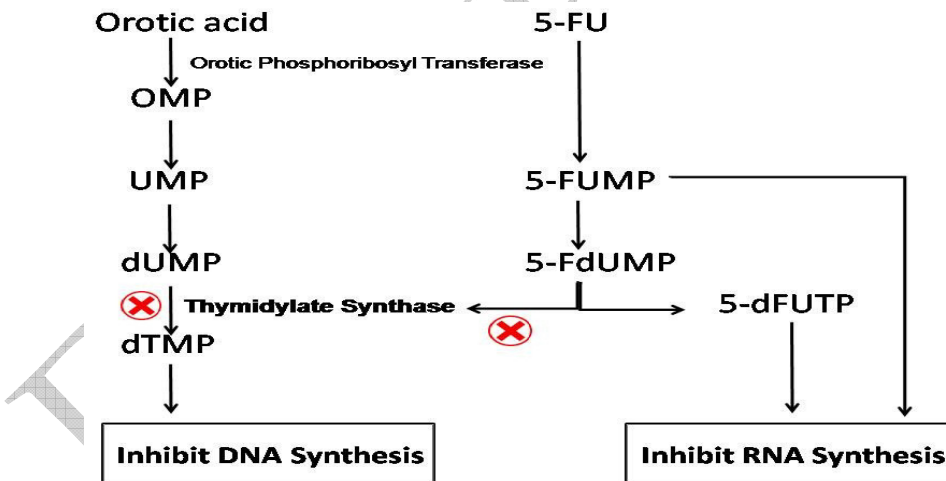
## Enzyme

### 60. Allopurine causes suicide inhibition



- Allopurinol makes competitive inhibition of xanthine oxidase enzyme.
- As well as Allopurinol is converted to Alloxanthine
- Which inhibit the xanthine oxidase of purine catabolism, more potently.
- And reduce formation of uric acid
- So it is useful in Gouty arthritis.

### 61. 5-Fluorouracil (5-FU) cause suicide inhibition.



- 5 Fluorouracil is analogous to orotic acid as well as to uracil.
- 5 Fluorouracil is inhibiting formation of OMP.
- As well as it will be converted to more potent product FdUMP.
- FdUMP cause competitive inhibition to thymidylate synthase enzyme.
- Ultimately, it cause suicide inhibition of RNA & DNA synthesis.
- Hence it used in malignancy.

## Biochemistry Justification

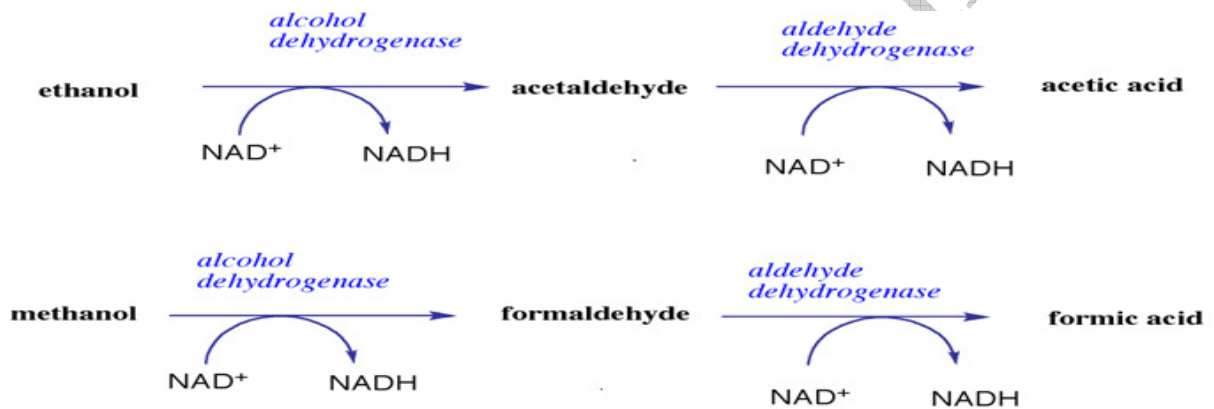
### 62. Aspirin causes suicide inhibition.

- Aspirin inhibit cyclo-oxygenase enzyme.
- CoX make synthesis of prostaglandin and thromboxane.
- If it is inhibited, this PG and TBX synthesis inhibited.
- Hence aspirin use as anti-inflammatory and anti-platelet agent.



- Aspirin inactivate COX enzyme through acetylation of it.
- But Simultaneously, Aspirin is converting into another product, Salicylic acid.
- So, It called that Aspirin causes suicide inhibition.

### 63. Ethanol is use as antidote in methanol poisoning.



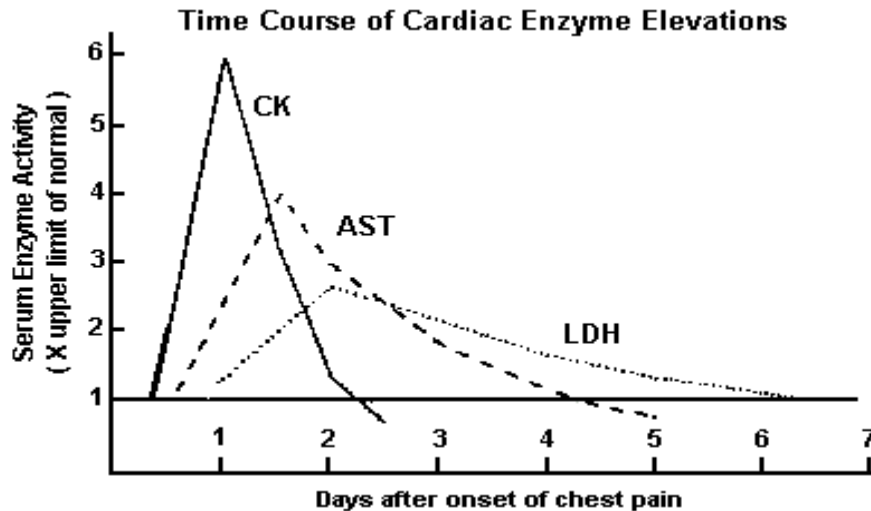
- Ethanol is analogous to methanol
  - Alcohol dehydrogenase has higher affinity to ethanol than methanol.
  - So Ethanol makes competitive inhibition of methanol metabolism.
  - So Decrease production of formaldehyde
  - So Decrease toxicity of methanol
- Therefore, Ethanol is use in methanol poisoning.

### 64. To maintain blood glucose after meal glucokinase play important role than hexokinase.

- Both the enzyme, Glucokinase and Hexokinase, convert Glucose into Glucose 6 Phosphate.
- But Presence of Glucokinase only in liver cell (hepatocyte) helps for glycogen synthesis and store.
- While Presence of Hexokinase in all the body cell helps for glycolysis and energy production.
- Glucokinase has high  $K_m$  value (10 mM) than Hexokinase (0.01 mM).
- It means at higher glucose level after meal, Glucokinase enzyme became active and convert that excess glucose in glycogen.
- So Blood glucose level remains maintain.

## *Biochemistry Justification*

65. "CK-MB is more significant marker than LDH & S.GOT for diagnosis of Myocardial infarction" explain it.



- GOT(AST)
  - Present in Liver, Gall bladder, Cardiac muscle
  - Non specific for cardiac muscle
- LDH
  - Present in Liver, Gall bladder, Cardiac muscle, Skeletal muscle, RBC
  - Non specific for cardiac muscle
- Creatine phosphokinase - MB (CK-MB)
  - Earliest to rise after myocardial infarction
  - Rise within 4-6 hours of the chest pain
  - Specific for cardiac muscle injury

Enzyme	Detectable Rise	Peak value of abnormality	Total Duration of abnormality
CK-MB	4- 6 hours	12 - 24 hrs	2 - 3 days
GOT (AST)	6 - 12 hours	1 - 2 days	4 - 6 days
LDH	18 - 24 hours	2 - 3 days	6 - 10 days

- Enzyme detectable durations in Case of Myocardial Infarction
- CK-MB is rise earlier as well as specific myocardial injury in compare to GOT & LDH.
- So CK-MB is more significant than LDH & GOT for diagnosis of myocardial infarction.

# Biochemistry Justification

## Nutrition & Vitamins

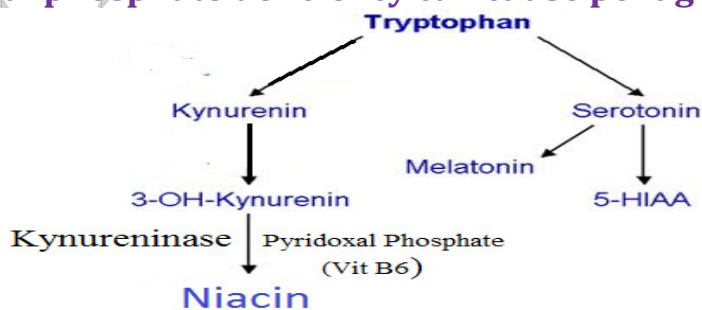
### 66. Kwashiorkor leads to oedema.

- Kwashiorkor is protein energy malnutrition (PEM)
- So, There is associated with decrease plasma albumin concentration.
- Because of low protein, there is decrease in osmotic pressure and comparatively high hydrostatic pressure.
- Because of that, water is shifted from intravascular space to extracellular space
- This is called as Oedema.

### 67. Vitamin C deficiency can cause scurvy

- Vitamin C is require for activation of Lysyl hydroxylase and Proyl hydroxylase enzyme.
- These, two enzyme, convert lysine and proline into hydroxylysine and hydroxyproline.
- And there make interchain hydrogen bonding (cross linking) in collagen fiber.
- This cross linking gives strength to the connective tissue.
- Thus, in vitamin C deficiency, connective tissue of vessels, bone as well as of gum tissue loss it's strength.
- That makes gum bleed , superficial vessel damage as well as bone deformities.
- Which is called Scurvy. Vitamin C is require for activation of Lysyl hydroxylase and Proyl hydroxylase enzyme.
- These, two enzyme, convert lysine and proline into hydroxylysine and hydroxyproline.
- And there make interchain hydrogen bonding (cross linking) in collagen fiber.
- This cross linking gives strength to the connective tissue.
- Thus, in vitamin C deficiency, connective tissue of vessels, bone as well as of gum tissue loss it's strength.
- That makes gum bleed , superficial vessel damage as well as bone deformities.
- Which is called Scurvy.

### 68. Pyridoxal phosphate deficiency can cause pellagra.



- Because of pyridoxal phosphate deficiency , decrease activity of kynureninase.
- Hence, Pyridoxal phosphate(Vitamin B6) deficiency decrease endogenous synthesis of niacin from tryptophan and increase chance of Pellagra.

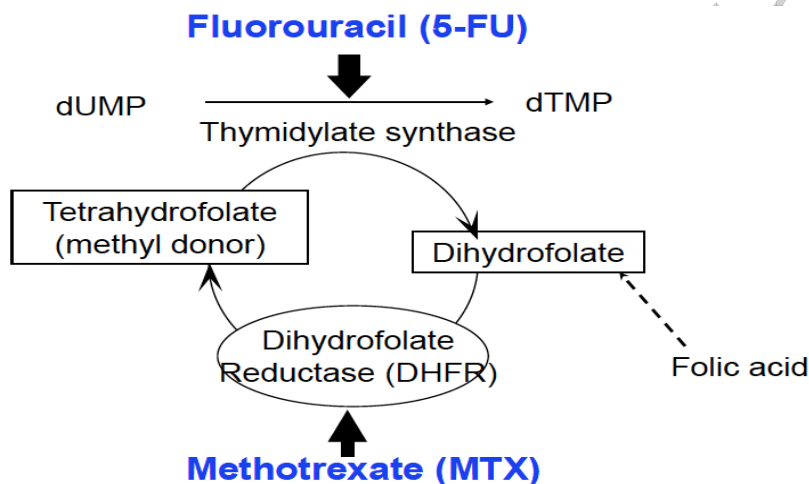
# Biochemistry Justification

## Molecular Biology

### 69. "Mutations are always harmful." True or False, Explain it.

- Due to the degeneracy property of genetic codon, if third base of genetic codon get substitution type of mutation, than it may represent same amino acid. So that mutation does not make any effect, which is called silent mutation.
- If mutation occur in intron, which is a largest part of DNA, than it does not affect protein synthesis. Because intron does not make any expression for protein synthesis.
- So In both case ,There is no any protein structure & function changes.
- So Mutation are not always harmful.

### 70. Methotrexate (Folic acid analogues) is used to treat neoplastic disease.



- Folic acid is require for purine & pyrimidine biosynthesis.
- Methotrexate is analogous to folic acid.
- So it act as competitive inhibitor with dihydrofolate reductase (DHFR) enzyme.
- And decrease formation of tetrahydro-folate as well as dTMP.
- So DNA replication is inhibited and So it is useful in treatment of neoplastic diseases.

### 71. Frameshift mutation is more dangerous than point mutation.

- In point mutation, there is possibility of only single amino acid change in protein structure because of substitution of single nitrogen base. Which is less dangerous.
- In frame shift mutation, one of nitrogen base of triplet codon either inserted or deleted.
- Because of that , reading frame for triplet codon is completely shifted.
- So whole amino acid sequence of required protein get change.
- Which cause complete deficiency of that protein.
- Therefore Frame shift mutation is dangerous than point mutation



## *Biochemistry Justification*

### **72. Telomerase inhibitors can be use in treatment of malignancy.**

- After removal of RNA primer from 5' end of new DNA, it became shortened at 5' end in compare to 3' end.
- This 3' end of DNA is called telomere.
- Telomerase enzyme elongate 5' end of DNA in complimentary to 3' telomere end of the new DNA.
- If Telomerase enzyme is inhibited, after each subsequent replication, new DNA get shortened and shortened.
- And decrease life of cell.
- So, Telomerase inhibitors can be use in treatment of malignancy.

### **73. UV radiation can cause Xeroderma pigmentosum (skin cancer).**

- Ultra-Violet rays exposer on skin
- ↓
- "Pyrimidine Dimer" type of DNA Damage
- ↓
- Which prevent DNA polymerase action beyond this dimer.
- ↓
- Damage to DNA
- ↓
- Nucleotide excision repair + UV Specific endonuclease enzyme to repair damage
- ↓
- If there is defect in nucleotide excision repair mechanism or
  - UV Specific endonuclease Enzyme deficiency
- ↓
- Can cause Skin cancer = Xeroderma Pigmentosum

### **74. DNA replication is semi-conservative.**

- In DNA replication, There is two new copy of double DNA synthesis.
- In each newly synthesized double DNA, there is one strand from parents DNA and another strand is daughter DNA.
- So it is called semi-conservative.

## *Biochemistry Justification*

### **75. Genetic code is degenerated.**

- Degeneracy indicate multiple elements, which correspond to one element.
- Total 64 genetic codon are representing for 20 amino acids.
- In this multiple codon may be representing for the same amino acid during translation.
- Which can prevent harmful effect mutation.
- Hence, Genetic codon is degenerated, which minimize effect of a mutation.

Dr Piyush Tailor