Biochemistry Justification

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"Special Thanks To All My Students"

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Chapter - 1

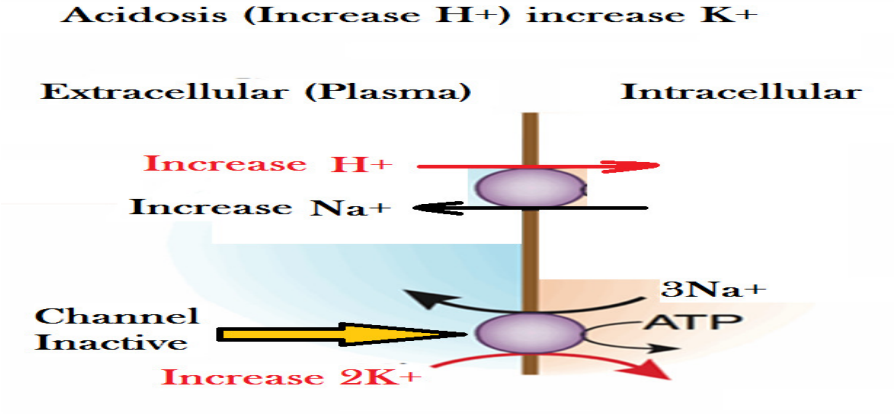
General Biochemistry

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,



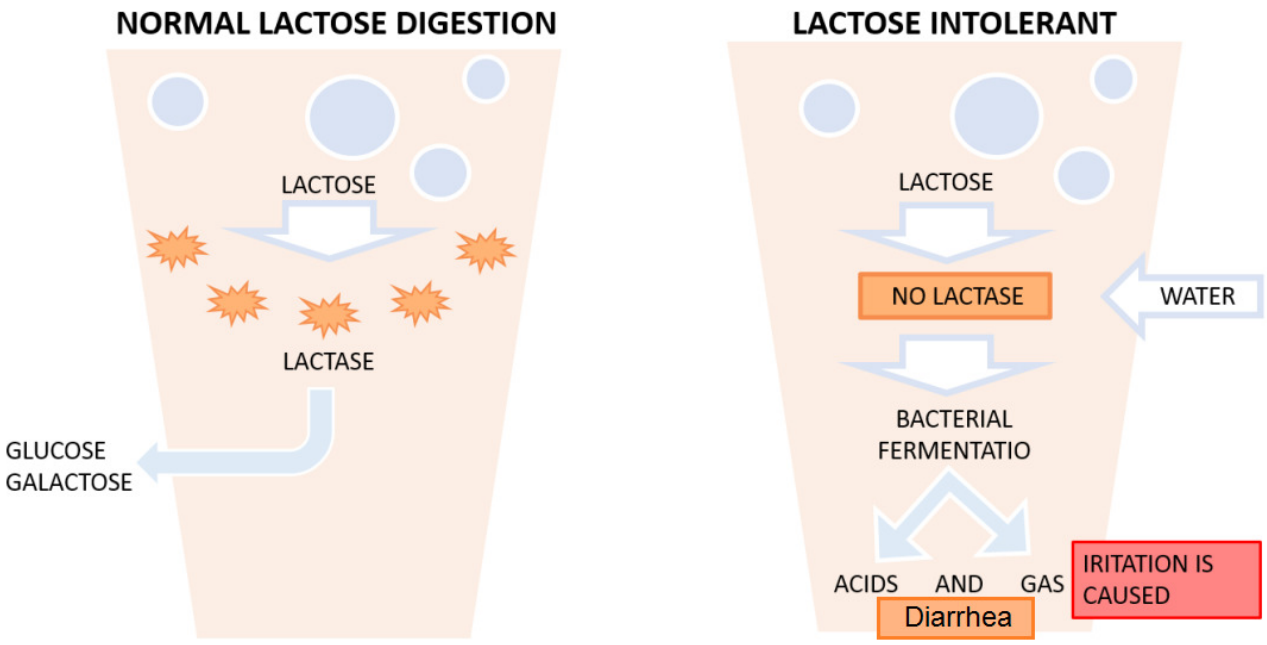
3. Blood Buffers act quickly but not permanently.

- 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.

Chapter - 2
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 remain accumulate in intestine
  - ✓ Because of osmotic property of lactose , it draw the water from intestinal cell to intestinal lumen.
  - ✓ Accumulate lactose causes fermentation and gas production 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 osmotically active substance.
- So when it is given orally or per rectally, it pull water into lumen of the intestine from intravascular & intracellular space.
- That increase water content of stool and ultimately softening of stool
- Which make easy defecation.
- So Glycerol is used in enema.

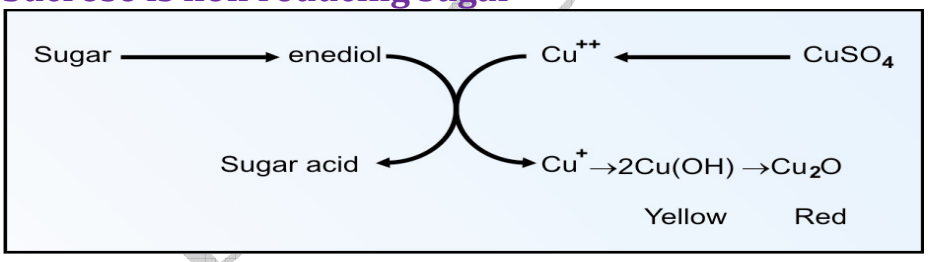
6. Acarbose is used in treatment of diabetes mellitus?

- Starch is there in the most of our food, as carbohydrate.
- Which is digested by amylase enzyme.
- Acarbose is structurally analogues to starch.
- So Through competitive inhibition , it inhibit action of amylase.
- So it decrease breakdown & digestion of starch.
- So Less amount of glucose get release and less get absorb from intestine.
- Which help to keep lower glucose level after food.
- 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 became charge molecule.
- Amine group has negative charge and sulfate group has positive charge.
  - Because of negative and positive charge , some part of proteoglycan chain has repulsion and some has attraction in between.
  - Because of that charge, it can attract more amount of water.
- So it can keep medium spongy as well as jelly like.
- So it can absorp shocks and work as lubricant also.

8. Sucrose is non reducing sugar



- Sucrose is made of Glucose and Fructose with alpha 1-2 glycosidic linkage.
- Function group- aldose of Glucose is at 1st carbon.
- Function group- keto of fructose is at 2nd carbon.
- But function groups are involve in alpha 1-2 glycosidic .
- So no functional group is free to form an enediol.
- So no reduction of copper sulfate
- Negative benedict test.
- So “Sucrose is called non reducing sugar.”

9. Sucrose is invert sugar

- Sucrose (+ 66.5º) = Glucose (+52.5º) + Fructose (- 92º)
- Sucrose is Dextro rotatory
- While sucrose get hydrolysis, fructose give more levo-rotation than glucose dextro rotation.
- So after hydrolysis of sucrose became levorotatory.
- So there is change in rotation from dextro to levo.
- So sucrose is called invert sugar.

10. Dextran is use as plasma volume expander

- Dextran is polysaccharide with high molecular weight.
- Dextran has alpha 1-6 glycosidic linkage in straight chain formation, and alpha 1-3 glycosidic linkage at branching.
- Human does not have enzyme to break alpha 1 -3 glycosidic linakge.
- So as it is given intravenously , it remain as unbroken- high molecular weight polysaccharide in circulation.
- So it provides more osmotic properties in intravascular space.
- Pull more water into intravascular space and keep it there for longer time.
- It increases blood volume and reduces viscosity of blood.
- thus it used as plasma expander in treatment of shock.

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

- Myocardial infarction is complete occlusion of coronary artery due to formation of thrombosis.
- That decreases blood supply as well as oxygen supply to myocardium.
- In absence of oxygen, myocardium does anaerobic glycolysis for energy purpose.
- Due to anaerobic glycolysis, glucose is convert to pyruvate and pyruvate converted to lactatic 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 fromtion the sample.
- So during transportation and processing time, when sample get delay in analysis, glucose may utilized by these cell and it get reduced.
- Which gives false low result of blood glucose.
- In presence of fluoride, Enolase enzyme of glycolysis is inhibited. Which prevent utilization glucose by the cell .
- That gives correct value for blood glucose in blood smaple.
- So Fluoride containing vial is use for collecting blood for blood sugar estimation.

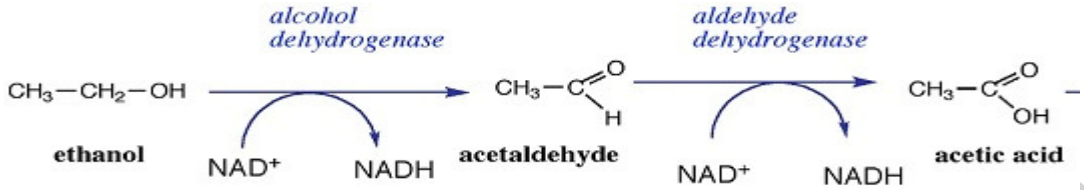
14. Primaquine administration in G6PD deficient patient can precipitate hemolytic anaemia.

- Decreased activity of G6PD impairs Hexose Monophosphate (HMP)Shunt.
- Thus there is no synthesis of NADPH as well as no formation of reduce glutathione in RBC .
- Primaquire induce free radical formation (oxidative stress) in RBC.
- To over come this oxidative stress, NADPH is require to form reduce glutathione in RBC.
- Which is deficient in G6PD patients.
- Administration of primaquine to this type of patient make damage RBC membrane, due high amount of free radical
- Which induce hemolytic anaemia & haemolytic jaundice.

15. 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
  - causes it's breakdown.
  - decreasing it's viscosity
  - increasing the tissue permeability .
- Hence bacteria and various toxins can easily migrate into the tissues and cause cellulitis.
- So Hyaluronidase is called as the spreading factor.

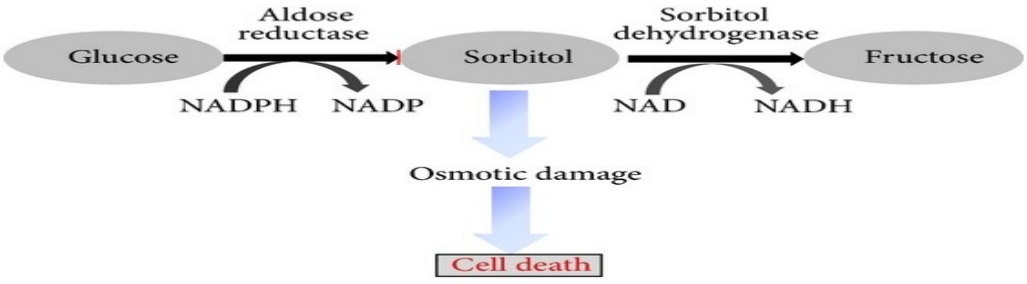
16. Alcohol inhibit gluconeogenesis.
17. Alcohol causes hypoglycemia, if person is on starvation.



- Main substrate for gluconeogenesis are
  - Pyruvate
  - Oxaloacetate
  - Intermediate of TCA cycle
- Ethanol and Methanol both increase NADH:NAD ratio.
- The high concentration of NADH
  a. Convert all pyruvate into lactate.
  b. Decrease production of Oxaloacetate from malate.
  c. Inhibit TCA cycle
- Because of increase concentration of NADH, availability of main substrate for gluconeogenesis is decrease and it become slow and inhibited.

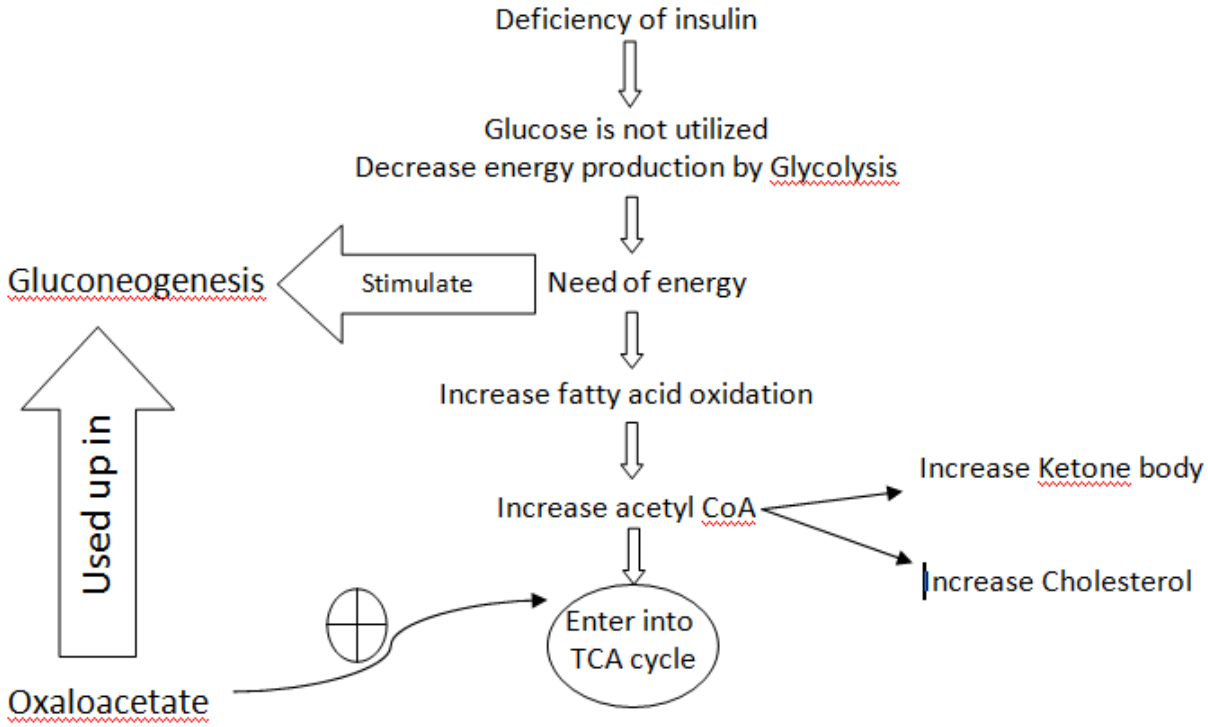
18. Cataract is more common in diabetes mellitus.

- **Due to "Advance Glycated End Product"**
- Due to high amount of glucose
  - Increase glycation of crystalline protein of lens
  - Causes denaturation of crystalline protein of lens
  - Which cause opacity in lens.
- **Due to "Polyol Pathway"**



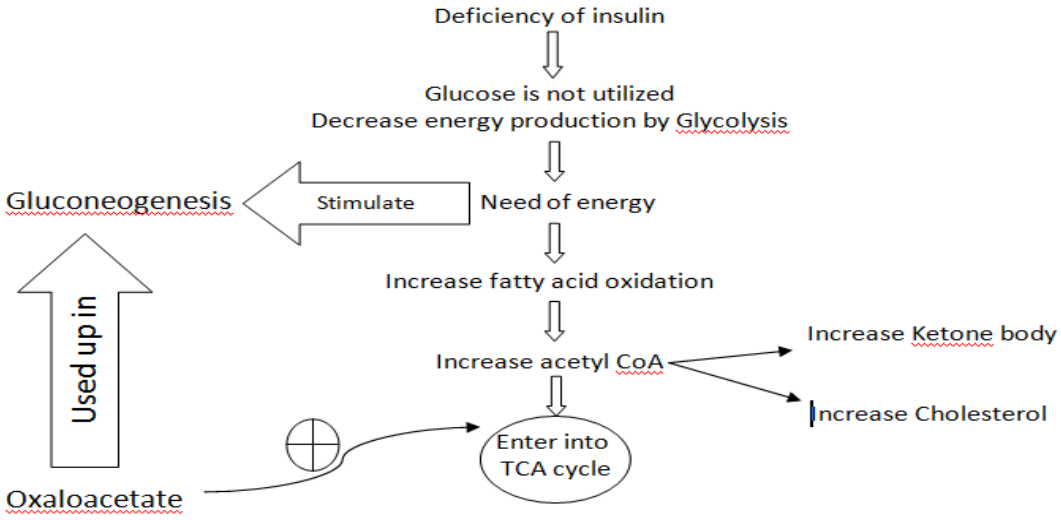
- In lens, kidney & nerve cell , enzyme sorbitol dehydrogenase of Polyol pathway is deficient.
- So, In the lens,
  - High glucose produce high sorbitol, but this sorbitol can not diffuse out of lens.
  - High sorbitol pull more water into lens and make lens swelling & opacity.
- This opacity of lens is called cataract.

19. Patient of IDDM have more risk of diabetic ketocidosis than NIDDM.



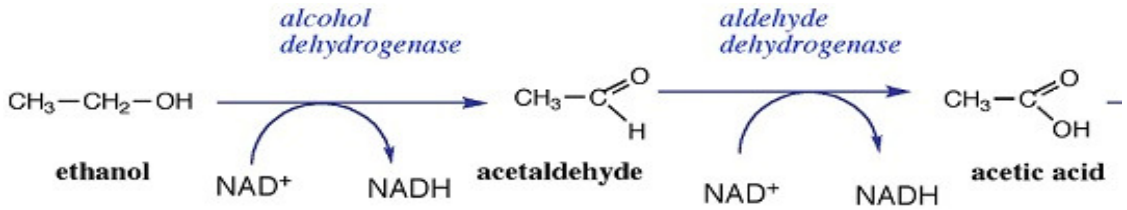
- In type II diabetes mellitus
  - High glucose level
  - High insulin level.
  - Decrease sensitivity of receptors
- So, some amount of glucose can be utilized by cell. Which
  - Prevent proteolysis – less formation of Acetyl CoA.
  - Prevent fatty acid oxidation - less formation of Acetyl CoA.
  - Prevent utilization of oxaloacetate by gluconeogenesis – more Acetyl CoA can enter into TCA cycle.
- So less acetyl CoA available for ketone body synthesis, because of less acetyl CoA synthesis and more entry of acetyl CoA in TCA cycle.
- So in type II diabetes mellitus, there is less chances of Diabetis Ketoacidosis.

20. Uncontrolled diabetic mellitus patient has more risk of atherosclerosis.



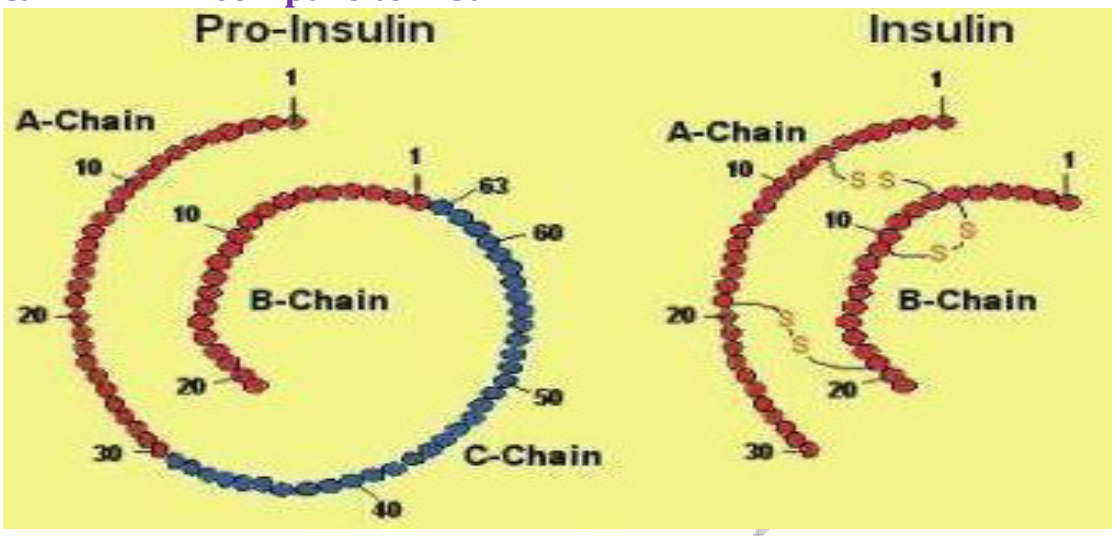
- In Uncontrolled diabetes mellitus,
  - Glucose can not utilized by Cell
  - More gluconeogenesis
  - More Proteolysis
  - More Fatty acid oxidation for energy production.
  - So there will be more Acetyl CoA formation.
- Simultaneously, due to stimulation to gluconeogenesis
  - Less oxaloacetate available , which prevent entry of acetyl CoA into TCA cycle.
- That excess acetyl CoA make synthesis of
  - More cholesterol formation
  - More ketone body formation
- Hence, Uncontrol Diabetes mellitus , there is more risk of atherosclerosis.

21. 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).
  - Increase lactic acid concentration
  - Lactic acid compete with uric acid for excretion in renal tubule
  - Decrease excretion of uric acid.
  - Increase uric acid level
- Due to high lactic acid level
  - Metabolic acidosis
  - Acidic pH converted uric acid into sodium urate crystal.
- Hence, Chronic alcoholism cause gouty arthritis.

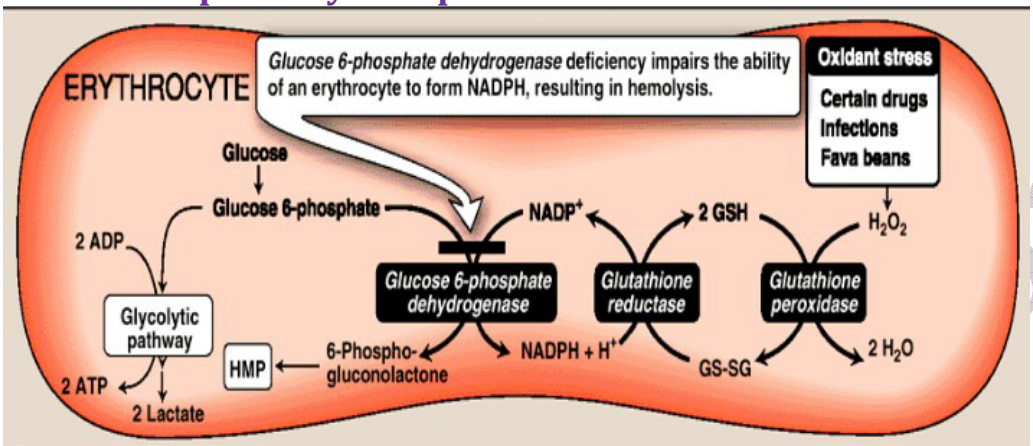
22. Estimation of C-Peptide is better parameter to differentiate IDDM & NIDDM in compare to insulin.



- Endogenous insulin synthesis in pre-pro-insulin form.
- When pre-pro-insulin is converted to the active insulin, simultaneously each molecular of pre-pro-insulin release connecting peptide (c-peptide).
- It means, endogenous Insulin & c-peptide are produced in equimolar concentration.
- C-Peptide level in plasma indicate endogenous production of insulin.
- IDDM= Decrease endogenous insulin production = Decrease C-peptide
- NIDDM= Normal / Increased endogenous insulin production = Normal / High C-peptide
- Plasma insulin level may alter by exogenous insulin administration.
- So, C-peptide is used to differentiate IDDM &NIDDM.

23. G6PD deficiency causes hemolysis.

24. HMP shunt pathway is important to RBCs



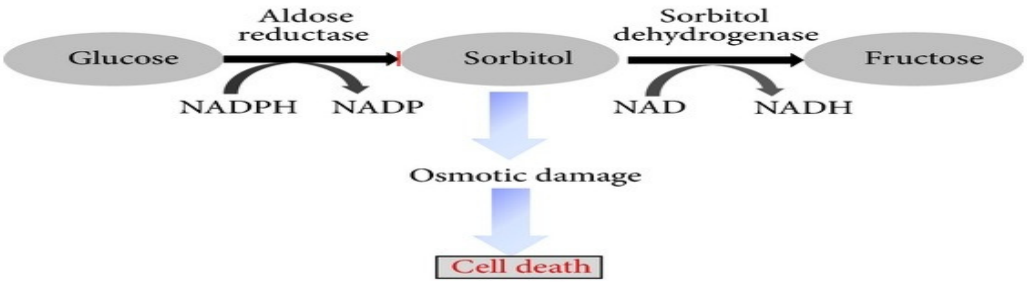
- Glucose-6-phosphate dehydrogenase (G6PD) is an enzyme of Pantose Phosphate Pathway (HMP shunt pathway)
- This pathway provide NADPH.
- This NADPH maintain reduce form of Glutathion (GSH) in the RBC.
- Reduce Glutathion (GSH) convert peroxides & free radical into non-toxic compound.
- E,g H2O2 is converted to H2O
- In G6PD deficiency, NADPH is not available in an erythrocytes to detoxify free radical.
- So , in case of free radical formation, RBC wall get damage and causes hemolysis.
- So, Although no ATPs are formed in HMP shunt pathways, it is important to RBCs.

25. Uncontrolled diabetes mellitus leads to neuropathy & retinopathy.

Ischemic damage to nerve

- Nerve damage due to microvascular damage due to uncontrol diabetes mellitus
  - Due to atherosclerosis
  - Due to arteriosclerosis due AGEs
  - Decrease blood supply to nerve ends
  - Cause ischemic changes in nerve ends
- Nerve damage due increase oxidative stress
  - Increase glucose, increase sorbitol accumulation in nerve cell.
  - More consumption of NADPH
  - More consumption of reduce glutathione
  - Decrease concentration of reduce glutathione & NADPH
  - Increases free radical concentration & oxidative stress
  - Increase nerve damage due to free radical.

Polyol Pathway



- In lens, kidney & nerve cell , enzyme sorbitol dehydrogenase of Polyol pathway is deficient.
- So, In the nerve cells,
  - High glucose produce high sorbitol, but this sorbitol can not diffuse out of nerve cell.
  - High sorbitol pull more water into nerve cell and make it's swelling.
- Which affect nerve conduction, which called neuropathy.

Decrease Myo-inositol formation

- Increase glucose to sorbitol conversion in nerve cell.
- Decrease NADPH due to more consumption of it in reaction.
- Decrease formation of Myo-inositol ,Phosphotidyl-inositol (PI) & diacylglycerol (DAG) , which are a secondary messenger for function of Na-K ATPase channel.
- Action potential generation is affected due to decrease Na-K ATPase channel activity
- Ultimately , nerve conduction is affected.

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.

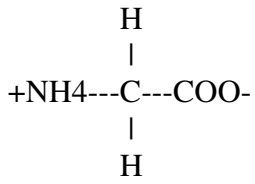
Chapter - 3

Protein

&

Amino acid

26. Glycine is optically inactive



- When a carbon atom bind to 4 different group, it is called “Anomeric carbon”.
- All alpha amino acids has atleast one anomeric carbon, which provide optical activity.
- So All the amino acids has optically active, either dextro-rotatory or levo-rotatory.
- 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.

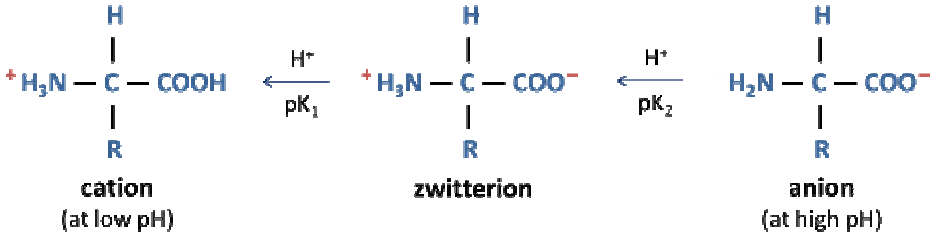
27. Peptide bond is called semi-double bond.

- Peptide bond is formed as the amino group (NH4+) of an amino acid bind with the carboxyl group (COO-) of next amino acid.
- 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 A°
  - Classical single bond (1.42A°)
  - Classical double bond (1.27A°).
- It suggest that rotation and distance between two A.A. of peptide bond is more than classical double bond as well as less than classical single bond .
- Hence Peptide bond is called semi-double bond.

28. Histidine & Arginine are semi-essential amino-acid

- Histidine and Arginine can be produce by normal hepatocyte in adulthood.
- In new born baby and infant, because of immature hepatocyte , it cannot be synthesized.
- So in new born 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.

29. Zwitter ions has no mobility in electrical field.



- Zwitter ions has equal number of positive and negative charges
- So it has net charge zero.
- pH, at which, zwitter ion form , is called pI (iso-electric).
- So, Zwitter ion behave as neutral molecule ,when it is kept in electrical field.
- So it has no mobility in electric field.

30. Zwitter ions has minimum buffering & solubility capacity.

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

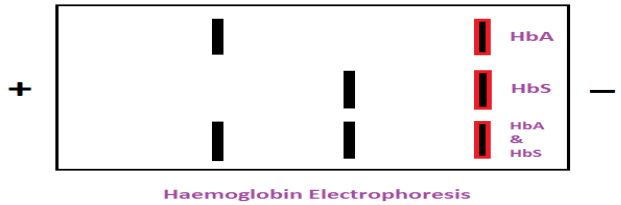
31. Row egg is use in treatment of metal poisoning.

- In case of metal poisoning , metal causes denaturation of protein of the gastro-intestinal cells.
- So , mucosa get damage and metal easily get absorb from G.I. track.
- Raw egg protein precipitate the metal.
- So , There will be less free metal to bind with gastro-intestinal mucosal protein.
- Which decrease damage to gastro-intestinal mucosa as well as metal absorption.
- And decrease toxicity of Metal poisoning.
- So Raw egg is used in metal poisoning as antidote.

32. Lead inhibit heme synthesis.

- Lead inhibit zinc containing enzyme ALA dehydratase and ferochelatase of heme synthesis , by replacing zinc (co-factor for same enzyme) from reaction.
- So, lead does uncompetitive inhibition of heme synthesis.
- So, Lead exposure can causes chronic anemia.

33. HbS move slower than HbA in alkaline gel electrophoresis.



Haemoglobin Electrophoresis

- Gel electrophoresis is a diagnostics test in sickle cell anemia.
- In sickle cell disease, there is replacement of glutamic acid by valine.
- Negative charged Glutamic acid is replace by neutral charged valine
- So HbS has less negative charge than HbA.
- As, less negative charged molecule move less in electrophoresis.
- So, during electrophoresis, in alkaline medium(pH 8.6),sickle cell haemoglobin (HbS) moves slowly towards anode(positive electrode) than adult haemoglobin (HbA).

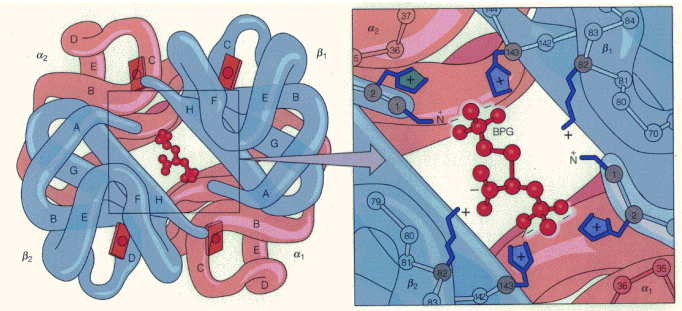
34. "Haemoglobin is good blood buffer".

- Haemoglobin is present in highest concentration in blood.
- Also , Haemoglobin contain maximum number (n=38) of imidazole group containing histidine as it's residual amino acid.
- Histidine's pk (6.8) value is very nearer to physiological pH, so it can bind more amount of H+ ions.
- So, maximum number of deoxygenated haemoglobin can bind with H+, due Haldane effect.
- Hence, "Haemoglobin is good blood buffer"

35. Blue fluoroscent light is useful in treatment of neonatal jaundice.

- Blue fluoroscent light penetrate the skin and that light is absorb by billirubin.
- Due to light absorption , Billirubin is converted into two isomers.
  - Z-Billirubin (Lumirubin , Structural isomer, Irreversible)
  - E-Billirubin (Photobilirubin , configurational isomer, reversible)
- Both are less lipophilic than normal billirubin.
- So without involvement liver and conjugation process, indirect billirubin is converted to water soluble billirubin.
- This billirubin can excreted though bile and urine.

36. 2,3 BPG decrease affinity of oxygen for hemoglobin.



- When 2,3-BPG binds to deoxyhemoglobin, it stabilize haemoglobin in "T state".
- It fits nearly into the cavity of the deoxy- conformation.
- Positive polarity of the phosphate of the 2,3-BPG form salt bridges with negative polarity of lysine and histidine residues of the ß subunits of hemoglobin.
- In "T state" of the haemoglobin , it make difficult for oxygen to bind with haemoglobin.
- So oxygen get release from haemoglobin to adjacent tissues.
- 2,3-BPG is part of a feedback mechanism to prevent tissue hypoxia, in conditions where there is chance of tissue hypoxia.

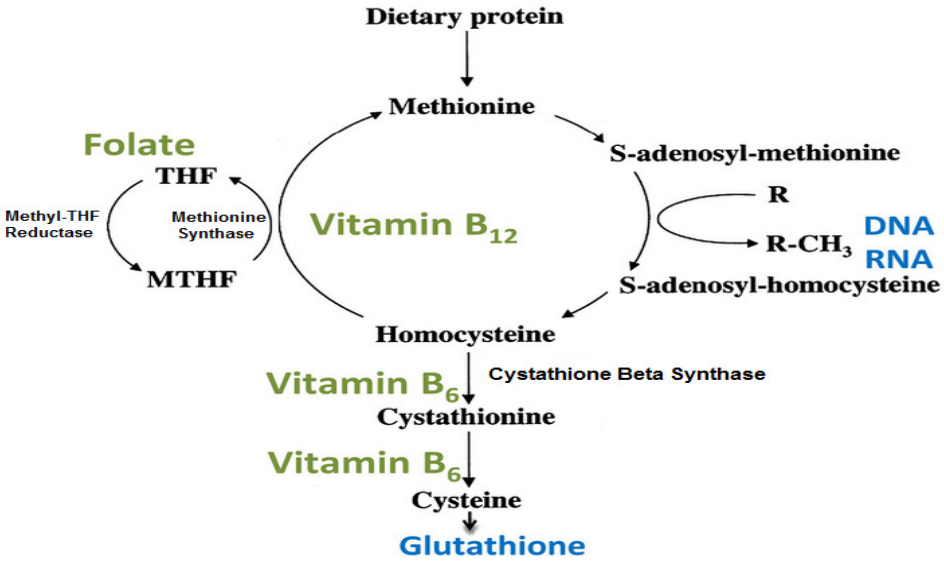
37. Photosensitivity does not occur in acute intermittent porphyria.

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

38. 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 homocysteine increase risk of atherosclerosis..

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

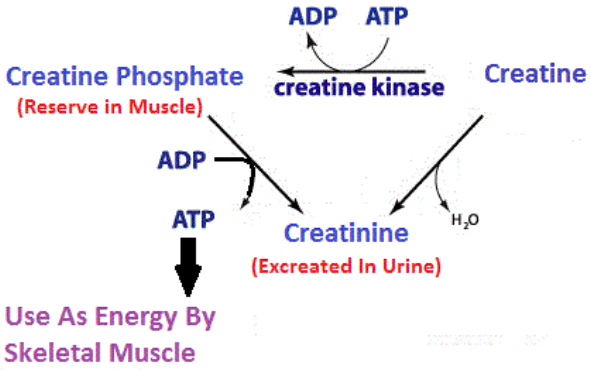


- Hyperhomocysteinemia leads to vascular disease
- Vitamin B12 & Folic acid is require as co-enzyme for action of methionine synthesis & methyl tetrahydrofolate reductase enzyme.
- And convert homocysteine to methionine.
- Pyridoxime phophate (Vit-B6) is require for cystathione synthase activity.
- Which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

40. Alpha 1 anti-trypsin deficiency cause emphysema.

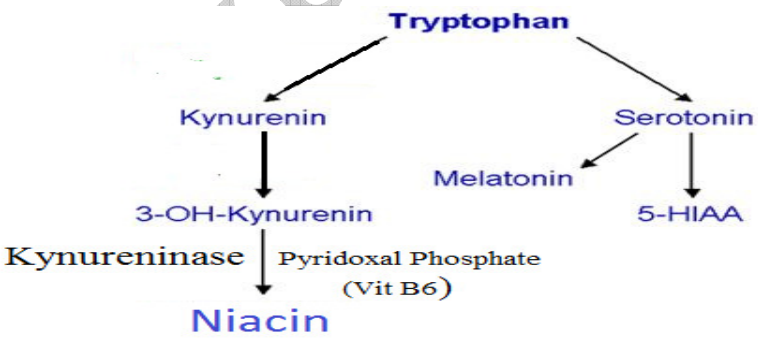
- Alpha 1 anti-trypsin inactivate elastase enzyme and prevent damage to elastic and collagen containing tissue like lung's alveoli.
- In it's deficiency, there is more activity of elastase enzyme.
- Lung's alveoli get damage due to over activity of elastase.
- And it causes emphysema.

41. Creatine is use to improve performance of athletes



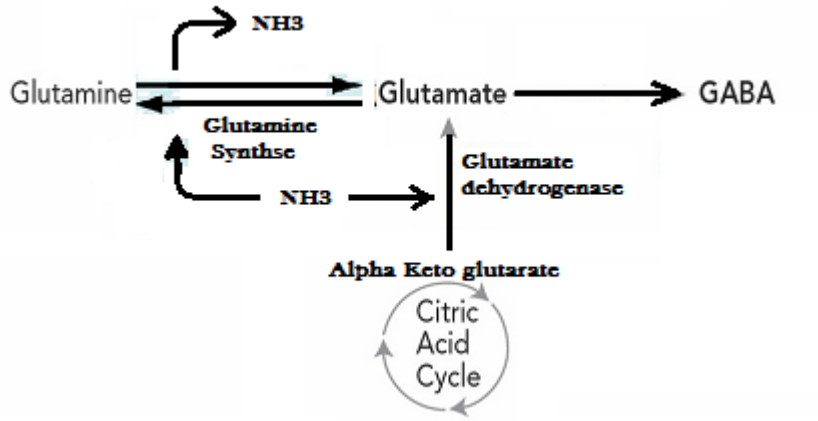
- Body has several ways to convert ADP back to ATP.
- This is the fastest method is to move the phosphate group of creatine phosphate to ADP , This yields ATP.
- Which is immediately available for muscular work .
- If creatine is supplied to athletes , it increase reserve store of creatine phosphate with action of enzyme creatine kinase.
- So, 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 improve athletic performance.

42. 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 decrease availability of tryptophan for niacin synthesis.
- Which leads to decrease niacin.
- Hence, deficiency of niacin leads to pellagra.

43. Increase ammonia is toxic to brain.



Mechanisms for toxicity of high Ammonia

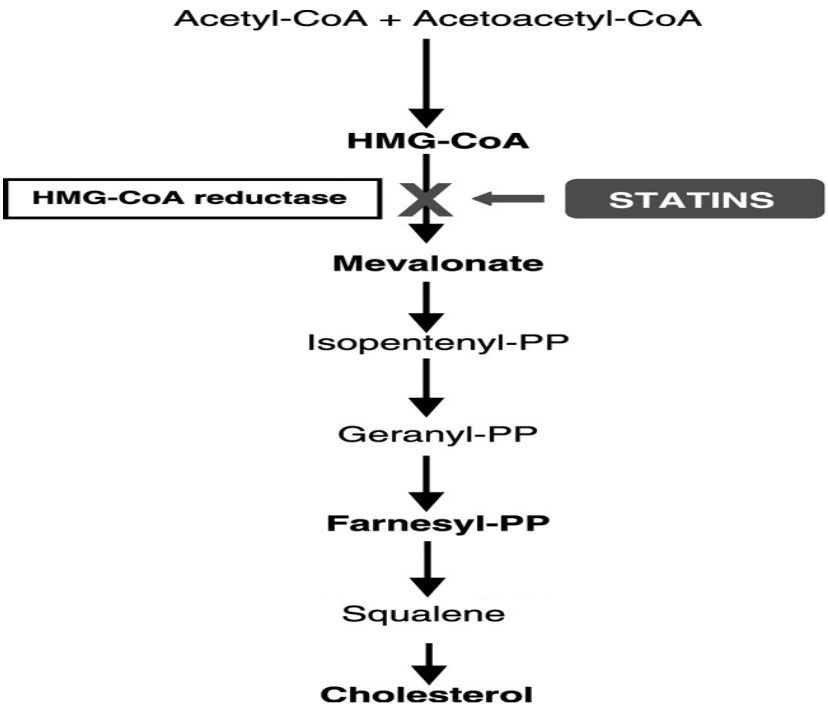
- High NH3 will drive Glutamine Synthase:
  - Glutamate + NH3 → Glutamine
  - This decrease glutamate.
  - So there is decrease synthesis of inhibitory neurotransmitter GABA.
  - That causes convulsion.
- High NH3 as well as decrease glutamate level will drive Glutamate Dehydrogenase reaction to
  - α-ketoglutarate + NH4+ → Glutamate
  - This result in depletion of α-ketoglutarate, which an essential krebs cycle intermediate.
  - Decrease α-ketoglutarate impairs energy metabolism in the brain.
  - Which impairs normal physiological brain activity.
- Due to high NH3 , concentration 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 get synthese.
  - Increase serotonine causes depressive effect on neurons.

Chapter - 4

Lipid

44. Sudden withdrawal of statin drugs will cause hypercholesterolemia.

- 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 Hypercholesteromia.



45. Pancreatitis leads to steatorrhea.

- Pancreas release lipase enzyme in duodenal cavity for digestion of lipid molecule.
- Lipase enzyme break ester bond of all the lipids , like triglyceride, cholesterol ester and phospholipid.
- In pancreatitis (inflammation of pancreas), there is decrease secretion of lipase enzyme from pancreas.
- Due to deficiency of lipase enzyme, Lipid molecule remains undigested.
- That lipid droplet get emulsified (split) because of bile salt but it cannot be digested due to lipase deficiency.
- And that undigested lipid – fat excreted in stool, which is called steatorrhea.
- So Patient of pancreatitis suffers a split steatorrhea.

46. Rancidity increases the risk of atherosclerosis.

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

↓

Increase formation of LDL as well as Oxidized LDL

↓

Injury to arterial endothelial wall

↓

Increase uptake of LDL by macrophages

↓

"Foam cell" accumulated

↓

Increase platelet and fibrin aggregation in lumen.

↓

Formation of plaque in the artery

↓

Increase risk of atherosclerosis.

47. Snake bite causes severe hemolysis

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

48. 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
- Ultimately no absorption of fat soluble vitamin (A,D,E,K) .
- Orlistat is supplemented with lipid soluble vitamins.

49. Orlistate is use as anti-obesity drug.

- Orlistate is an inhibitor of pancreatic and gastric lipase.
- It inhibit the active site of the lipase in GIT.
- So it prevent the absorption of fat.
- Undigested fat excreted in feces.
- So it use as anti-obesity drug.

50. High HDL level is decrease risk of coronary heart disease.

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

51. Pre-mature baby can suffer from Acute Respiratory Distress Syndrome.

- An fetus lung alveoli 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.
- In premature baby , lung alveoli are not develop to produce enough surfactant to decrease surface tension during respiration.
- Because of insufficient lung surfactant in alveoli, surface tension inside alveoli increase and causes collapse of the lungs alveoli.
- Which causes Acute respiratory distress syndrome.

52. Cystic fibrosis causes deficiency of lipid soluble vitamin.

- Cystic fibrosis is genetic disease due to mutation in CFTR (Cystic Fibrosis Transmembrane Regulator) gene.
- CFTR gene is representing channel protein of all the secreting gland
- These channel control water and chloride movement between cell and duct.
- Due to this channel abnormality , decrease reabsorption of chloride from secretion.
- So , in cystic fibrosis, pancreatic , gall bladder & all most all glands secret thick and sticky secretion, Which cause blockage in gland.
- Decrease bile & pancreatic secretion decrease digestion & absorption of fat.
- Simultaneously , it decreases digestion & absorption of fat soluble vitamins.

53. Oxidized LDL is important in pathogenesis of atherosclerosis.

Oxidized LDL

↓

Increases damage to interstitial wall of artery

↓

Increases deposition of LDL in macrophages

↓

"FOAM" cell formation inside interstitial wall of artery

↓

"FOAM" cell narrow the blood vessels & cause turbulent blood flow

↓

Plaque formation & Atherosclerosis

54. Linoleic acid and linolenic acid are essential fatty acid.

Linoleic: C18:2$\Delta^{9,12}$ (ω6)

CH3-(CH2)4-CH=CH-CH2-CH=CH-(CH2)7-COOH

Linolenic: C18:3$\Delta^{9,12,15}$ (ω3)

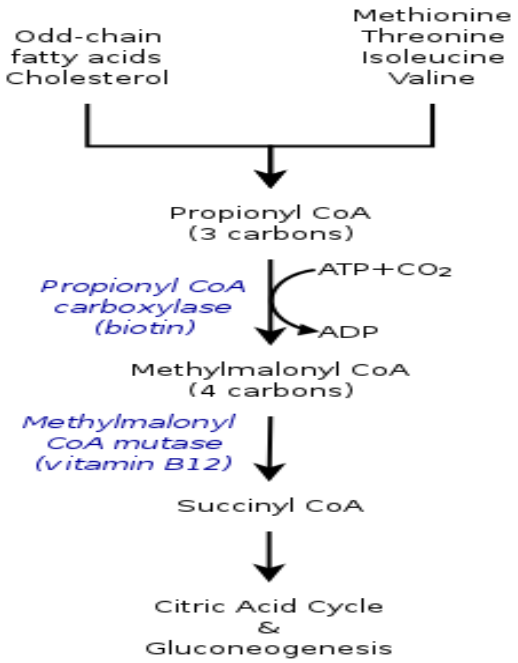
CH3-CH2-CH=CH-CH2-CH=CH-CH2-CH=CH-(CH2)7-COOH

- Linoleic acid and Linolenic acid are polyunsaturated fatty acid with 2 and 3 double bond subsequently.
- Humans have carbon 9, 6, 5 and 4 desaturases, which can form double bond in saturated fatty acid and convert it into unsaturated fatty acid.
- But human lack the ability to introduce double bonds from carboxyl carbon 10 to the ω-end (methyl end) of the chain.
- Linoleic acid is the precursor of arachidonic acid for formation of prostaglandin , leukotrienes and thromboxone synthesis (Eicosanoids synthesis).
- These eicosanoid are important for growth and development.
- So, Linoleic acid and linolenic acid are essential fatty acid.

55. Bile salts are detected in the urine of obstructed jaundice.

- Obstructive jaundice occurs due to obstruction of out flow of bile secretion.
- This obstruction can be due to involvement of duodenum ,liver, gall bladder and common bile duct.
- So there is reuptake of bile component like billirubin as well as bile salt - bile acid in hepatic circulation.
- So, there is increase direct billirubin and bile salts level in blood.
- This high billirubin and bile salts excreted in the urine.

56. Vitamin B12 deficiency causes methylmalonic aciduria.



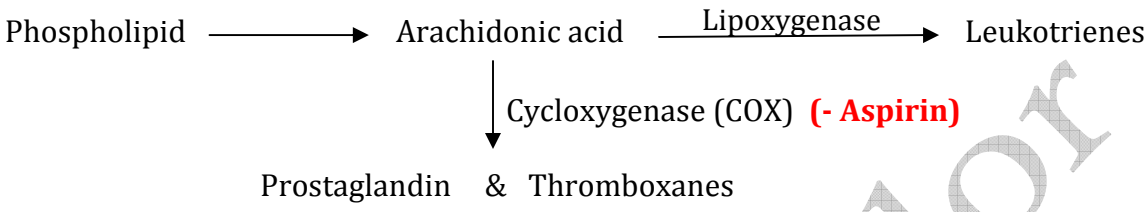
- Vitamin B12 is co-factor for methylmalonyl CoA mutase enzyme.
- So, in vitamin B 12 deficiency, there will be accumulation of methyl melonic acid in tissue and circulation.
- Especially it does neuronal disarrangement and newborn baby suffer from encephalophathy.
- Methamalonic acid excretion increase in urine.
- That condition is called " Methyl Melonic aciduria"

57. 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 of aspirin is covalently attached to serine residue in the active site of COX enzyme.
- Platelet does not have DNA.
- So it cannot synthesize new enzyme.
- So aspirin induces permanent & irreversible anti platelet effect.
- While endothelial cell has nucleus & DNA.
- So it can synthesize new enzyme .
- So Aspirin induces reversible anti-inflammatory effect.

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

59. Aspirin has short anti-inflammatory action while longer anti-platelet action.



- Aspirin inhibit cyclo-oxygenase (COX) enzyme.
- COX does synthesis of prostaglanding and thromboxone.
- If it is inhibited by aspirin, PG and TBX synthesis inhibited. Hence Aspirin is useful as anti-inflammatory and anti platelet agent.
- But, for anti inflammatory action , aspirin inhibit COX-2 enzyme of endothelial cell.
- Endothelial cell has short life span of 1 day.
- So , in few short time, new cell synthesis occurs which has new COX enzyme.
- This newly synthesized cell and COX enzyme over come the inhibition of aspirin.
- So Anti inflammatory action remain for short period.
- While for antiplatelet action, aspirin act on platelet cell's COX-1 enzyme.
- Platelet cell has life span of 5-7 days.
- Due to that inhibition of COX enzyme remains for longer time compare to endothelial cell and aspirin can for long time as anti-platelet.

60. When high dose of aspirin (NSAID) is use as anti-inflammatory, most commonly , it cause peptic ulcer.

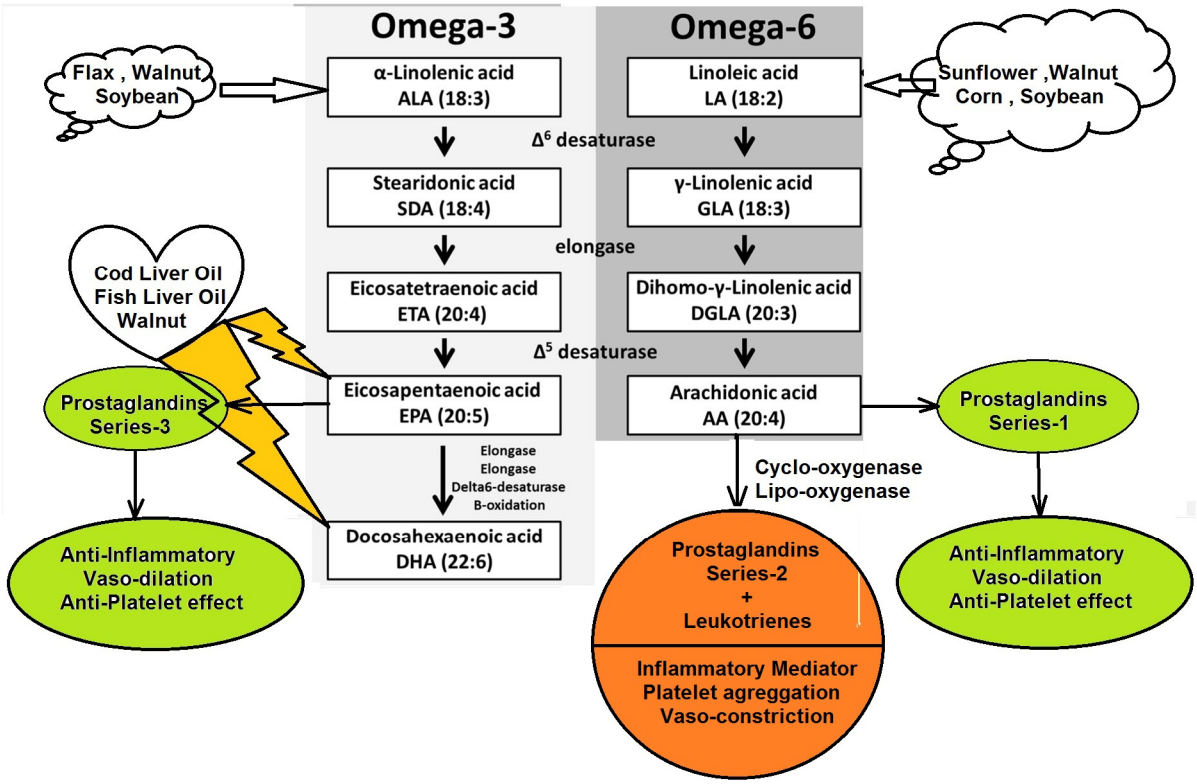
COX-1

- found in the kidney, stomach and platelets.
- play physiological role in protection of gastric mucosa, decrease gastric acid secretion and maintain normal functions of the kidney through prostaglainds.

COX-2

- located in macrophages, leukocytes and fibroblasts.
- produce only by induction from inflammatory mediator.
- synthesis prostaglandins which is responsible for pain and inflammation.
- Aspirin is non-selective COX inhibitor (inhibit both COX-1 & COX-2).
- Because of COX-2 inhibition, desired anti-inflammatory effect occurs
- Simultaneously , COX-1 also inhibited.
- Due to COX-1 inhibition , there will be decrease protection to gastric mucosa and increase gastric acid secretion.
- So , there will be increase chances of peptic ulcer.

61. Eicosapentaenoic acid and docosahexanoic acids in food are good for health
62. Eicosapentaenoic acid and docosahexanoic acids decrease risk of atherosclerosis.

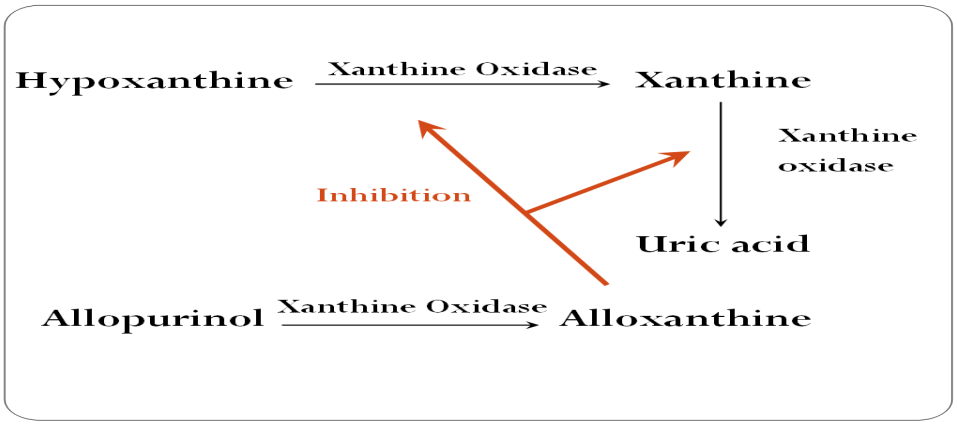


- Eicosapentaenoic acid (EPA) and docosahexanoic acids (DHA) is omega-3 fatty acid.
- It acts as precursor for Eicosanoid like Prostaglandin , Thromboxane ,Leukotriene
- As per above figure , if person take more amount of EPA & DHA, there will be good anti-inflammatory , anti-platelet affect and vaso-dilation effect, which can prevent cardio-vascular disease.
- If there is more consumption of Omega-3 fatty acid, competitively conversion from omega-6 fatty acid to arachidonic acid and formation of prostaglandins of series-2 decreases.
- So, There will be decrease effect of prostaglandins of series 2, like inflammatory mediators and platelet aggregation.
- So it can prevent atherosclerosis process as well as prevent coronary artery disease.
- EPA & DHA both are structural component of phospholipid of the cell membrane of brain cell and retina.
- To pregnant women, it is recommended for better development of brain cell in neonate.
- So it is consider good for cardiovascular and nervous system.

Chapter – 5

Enzyme

63. Allopurinol causes suicide inhibiton
64. Alloprinol is use in treatment of gouty arthritis



1st Mechanism

- Allopurinol is structural analogue of hypoxanthine as well as xanthine.
- So, Allopurinol causes competitive inhibition of xanthine oxidase enzyme.

2nd Mechanism

- Simultaneously , xanthine oxidase convert Allopurinol into Alloxanthine.
- Alloxanthine is also analogues to hypoxanthine and xanthine, but it can inhibit xanthine oxidase enzyme potently than allopurinol.
- As, inhibitor (allopurinol) is participating in reaction and converted to product, which more potent inhibitor (alloxanthine) of the same converting enzyme, it called suicide inhibition.
- Due to both mechanism, allopurinol reduce formation of uric acid
- So it is useful in treatment of gouty arthritis.

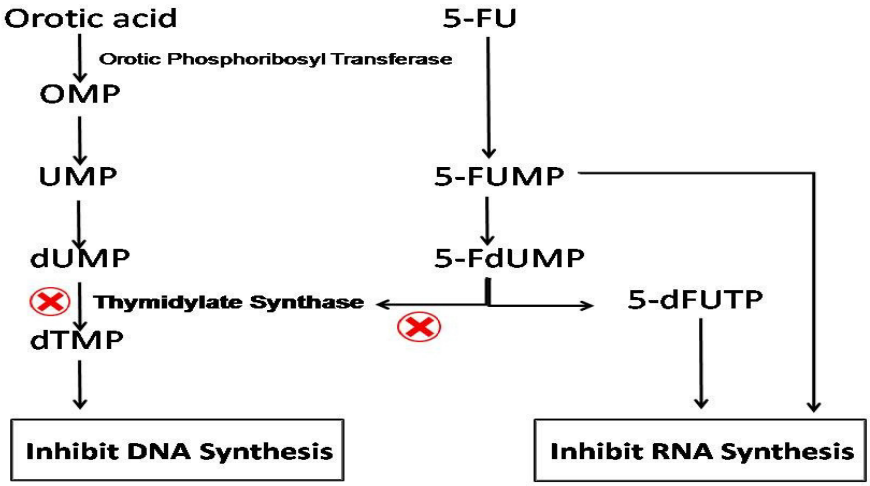
65. Aspirin causes suicide inhibition.

- Aspirin inhibit cyclo-oxygenase enzyme.
- CoX enzyme synthesis prostaglanding and thromboxone.
- If it is inhibited, PG and TBX synthesis is inhibited.
- Hence aspirin use as anti-inflammatory and anti-platelet agent.

Aspirin + COX (active) **-------->> Salicylic acid + COX** (Acetylated , Inactive)

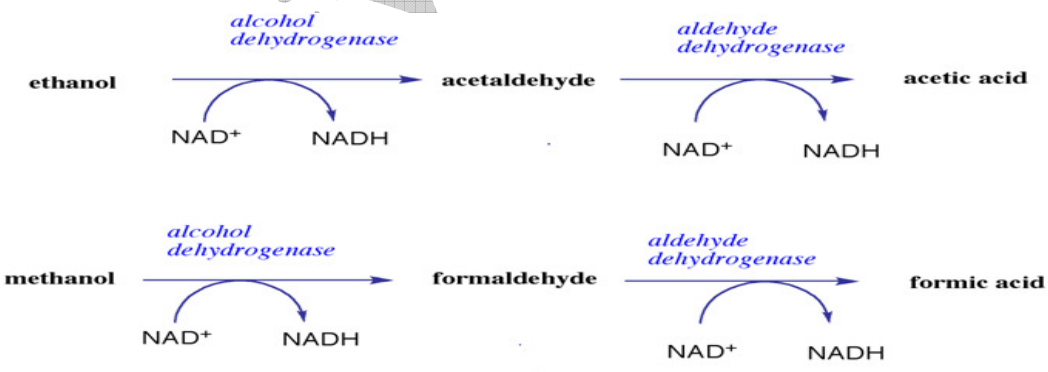
- Aspirin inactivate COX enzyme through acetylation of it.
- But Simultaneously , Aspirin is participating in reaction with CoX enzyme and converted into another product, Salicyclic acid.
- So, It called that Aspirin causes suicide inhibition.

66. 5-Fluorouracil (5-FU) causes suicide inhibition.
67. 5-Fluorouracil (5-FU) used in malignancy as chemotherapy agent.



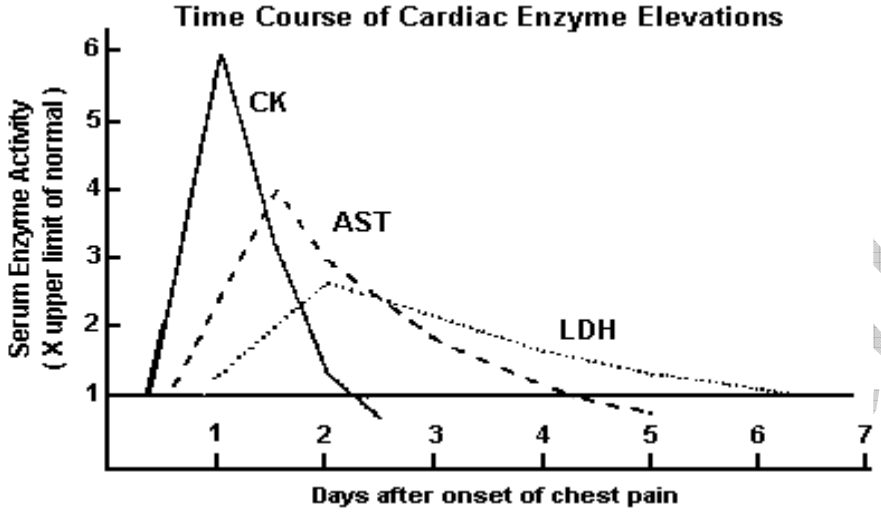
- 5 Fluorouracil is analogous to orotic acid as well as to uracil.
- 5 Fluorouracil is inhibiting formation of OMP.
- As well as it will be converted to more potent product FdUMP.
- FdUMP cause competitive inhibition to thymidylate synthase enzyme.
- Ultimately, it cause suicide inhibition of RNA & DNA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

68. Ethanol is use as antidote in methanol poisoning.



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

69. CK-MB is more significant marker than LDH & GOT for diagnosis of Myocardial infarction



- **GOT(AST)**
  - Present in Liver, Gall bladder, Cardiac muscle
  - Non specific for cardiac muscle
- **LDH**
  - Present in Liver, Gall bladder, Cardiac muscle, Skeletal muslce, RBC
  - Non specific for cardiac muscle
- **Creatine phosphokinase – MB (CK-MB)**
  - Present only in Cardiac muscle
  - Specifically raised in cardiac muscle injury - myocardial infarction
  - Rise within 4-6 hours of the chest pain

Enzyme detectable durations in Case of Myocardial Infarction

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

- 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.

70. To maintain blood glucose after meal glycokinase play important role than hexokinase.

- Both the enzyme , Glucokinase and Hexokinase , convert Glucose into Glucose 6 Phosphate.
- But glucokinase is present only in liver cell (hepetocyte), which helps for glycogen synthesis and store.
- While hexokinase is present in all the body cell, which helps for glycolysis and energy production.
- Glucokinase has high km 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.

Chapter - 6

Nutrition & Vitamins

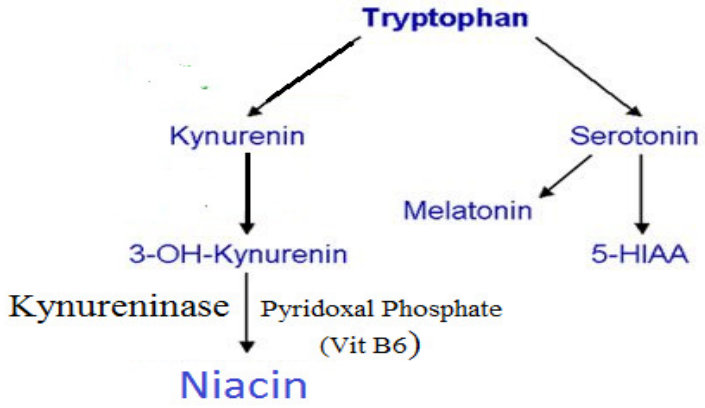
71. Kwashiorkor leads to oedema.

- 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.

72. Vitamin C deficiency can cause scurvy

- Vitamin C is require for activation of Lysyl hydroxylase & Proyl hydroxylase enzyme.
- These, two enzyme, convert lysine and proline into hydroxylysine & hydroxyproline.
- Which help in formation of inter-chain hydrogen bonding (cross linking) in collegen 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.

73. Pyridoxal phosphate deficiency can cause pellagra.

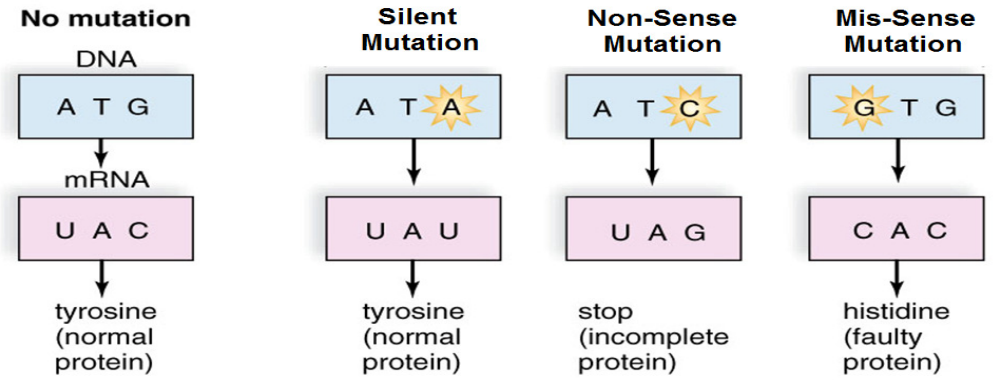


- Pyridoxal phosphate deficiency decrease activity of kynureninase.
- Hence, Pyridoxal phosphate(Vitamin B6) deficiency decrease endogenous synthesis of niacin from tryptophan and increase chance of Pellagra.

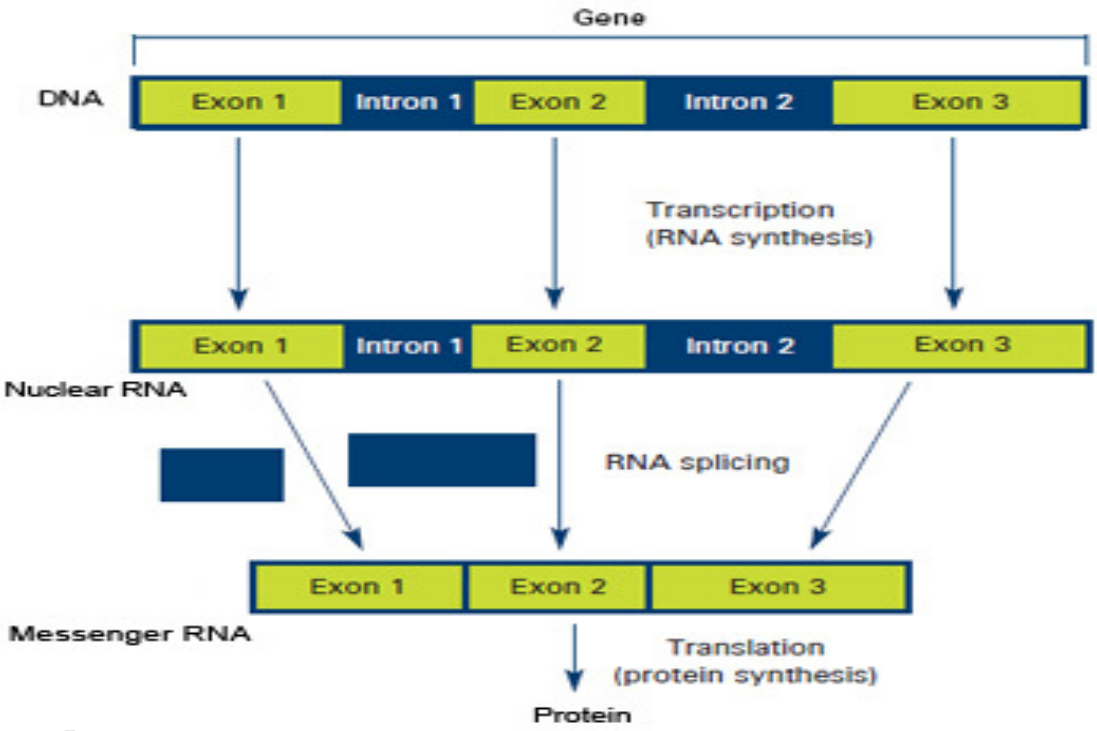
Chapter - 7

Molecular Biology

74. Mutations are not always harmful.

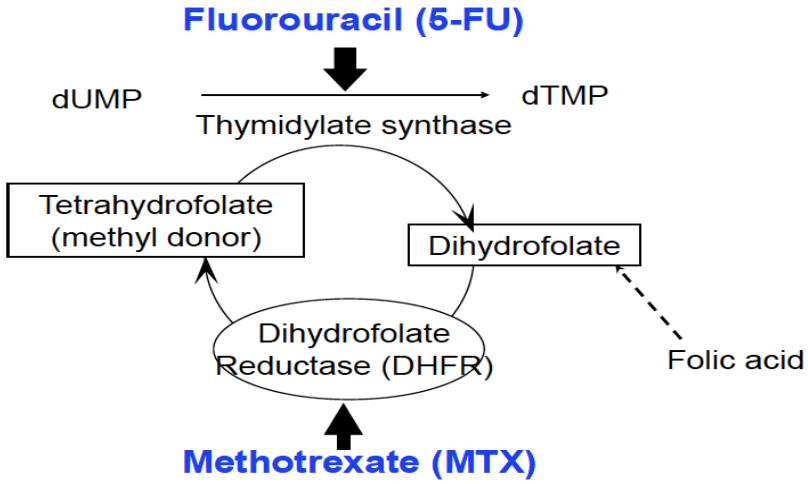


- Due to the degeneracy property of genetic codon, if third base of genetic codon get substituation type of mutation, than it may represent same amino acid. So that mutation does not make any effect, which is called silent mutation.



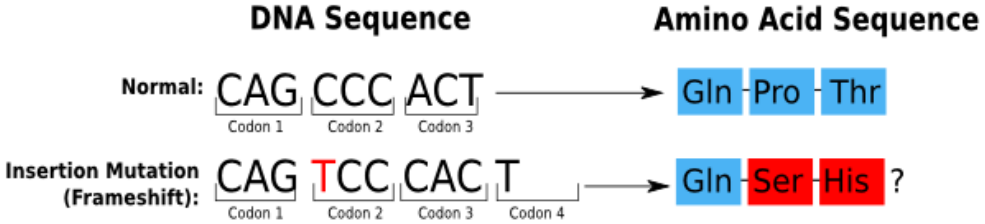
- If mutation occur in intron, which is a largest part (90%) of DNA, than it does not affect protein synthesis. Because intron does not make any expression for protein synthesis.
- So in both case ,there will be no any protein structure & function changes.
- And does not cause any abnormality nor disease.
- So Mutations are not always harmful.

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



- Folic acid is require for purine & pyrimidine biosynthesis.
- Methotrexate is analogus to folic acid.
- So it act as compititive 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.

76. Frameshift mutation is more dangerous type of point mutation.



- In point mutation, if there is substitution of single nitrogen base, there is possibility of only single amino acid change in protein structure. Which is less dangerous.
- While , in point mutation, if inserted or deletion of single nitrogen base of triplet codon, reading frame for triplet codon is completely shifted. Which is called “Frame Shift Mutation”
- So whole amino acid sequence of protein get change.
- Which cause complete deficiency of that protein.
- Therefore Frame shift mutation is dangerous type of point mutation.

77. Telomerase inhibitors is 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.

78. 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.

↓

So Damage to DNA

↓

Nucleotide excision repair + UV Specific endonuclease enzyme – repair this damage

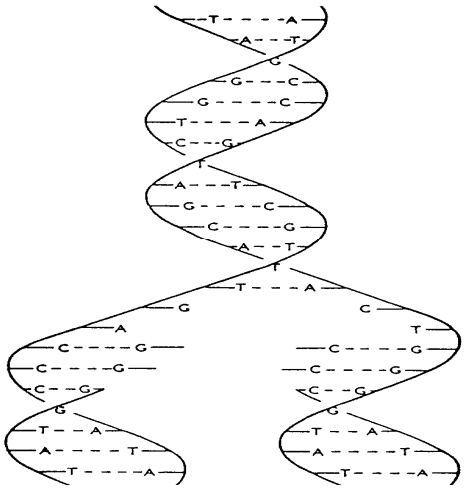
↓

If there is defect in nucleotide excision repair mechanism or
UV Specific endonuclease Enzyme deficiency

↓

Skin cancer occur = Xeroderma Pigmentosum

79. 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 other strand is daughter DNA.
- So it is called semi-conservative.

80. 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.