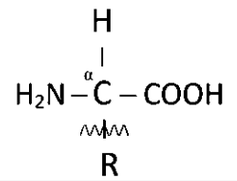
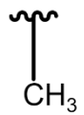
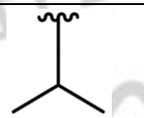
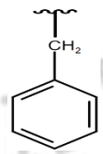
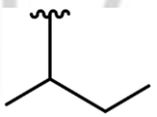
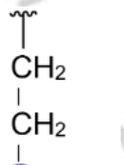
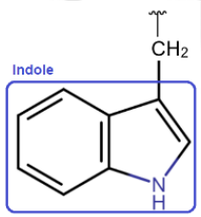
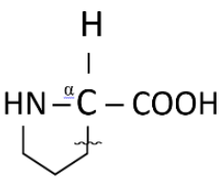
I. PROTEINS & ENZYMES

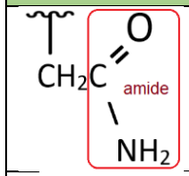
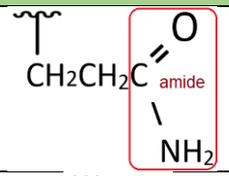
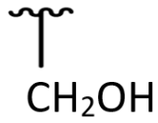
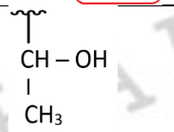
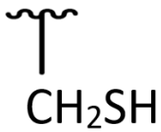
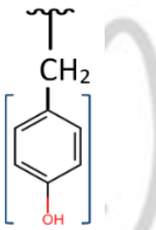
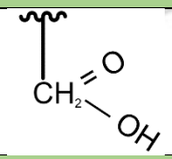
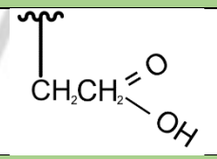
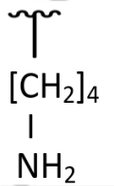
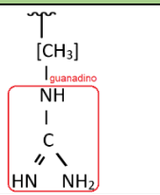
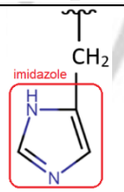
A. AMINO ACIDS



Classification by **R-Group**

A. NON-POLAR (Hydrocarbons) — VILFAG MWP

	**Glycine**	Gly	G	▪ smallest ▪ achiral ▪ starting material of **heme synthesis**	**BRANCHED CHAIN AMINO ACIDS**				**VIL**
	**Alanine**	Ala	A	▪ one of the commonly transaminated amino acid		**Valine**	Val	V	
	**Phenylalanine**	Phe	F	▪ aromatic amino acid **Xanthoproteic test** Rgt. HNO_3 (+) yellow/orange		**Isoleucine**	Ile	I	
	**Methionine**	Met	M	▪ sulfur-containing **Lead-acetate test** (+) black ppt		**Leucine**	Leu	L	
	**Tryptophan**	Trp	W	▪ aromatic ▪ indole-containing ▪ precursor of **Serotonin** (5-HT) **Hopkins-Cole** Rgt. glyoxylic acid (+) Violet-ring		**Proline**	Pro	P	▪ only 2˚ amine "imino acid" **Ninhydrin test** General test for amino acid (+) violet (1˚ amino acid) except Proline (yellow)

B. **POLAR** (OH,SH,NH)								QNSTCY (Cute ni Stacey)	
	**Asparagine**	Asn	N	▪ amidic		**Glutamine**	Gln	Q	▪ amidic
	**Serine**	Ser	S	▪ precursor of **choline**		**Threonine**	Thr	T	
	**Cysteine**	Cys	C	▪ thiol-containing ▪ part of **glutathione** **Nitroprusside** (+) red		**Tyrosine**	Tyr	Y	▪ aromatic ▪ phenolic ▪ precursor of **cathecolamine** (Epi, NorEpi, Dopa) **Millon's Test** Rgt. Hg^{+2} sol'n. (+) pink / rose
C. ACIDIC (2^{nd} COOH)								**AG**	
	**Aspartate / Aspartic Acid**	Asp	D			**Glutamate / Glutamic Acid**	Glu	E	
D. BASE (2^{nd} NH_2)								**LAH**	
	**Lysine**	Lys	K	▪ starting material for synthesis of Tranexamic acid		**Arginine**	Arg	R	▪ guanadino -containing **Sakaguchi test** Rgt. α napthol (+) red
	**Histidine**	His	H	▪ imidazole –containig **Pauly test** Rgt. Diazotized sulfanilic acid (+) red					

BY **METABOLISM**			BY **NEED (ESSENTIAL)**				
Ketogenic	**L L**	Leucine, Lysine	**P**	Phenylalanine	**H**	Histidine	→ Needed in diet, cannot be synthesized
Glucogenic	**The Rest**		**V**	Valine	**A**	Arginine	
Both	**T W I F Y**	Phenylalanine, Isoleucine, Tryptophan, Threonine, Tyrosine	**T**	Threonine	**L**	Leucine	
					L	Lysine	**Non-essential** (the rest) → Can be synthesize
			T	Tryptophan			
			I	Isoleucine	*** NO TYROSINE**		
			M	Methionine			

B. PEPTIDE STRUCTURE

Hydrolysis	Break	**Biuret test** – for presence of Peptide bonds; use Cu++ ions (+)violet / (-) hydrolysed
Condensation	Connect	

LEVELS OF ORGANIZATION

Primary	Peptide bonds	Sequencing rgts. (Sanger rgt. & Edman rgt.)
Secondary	H bonds between amide atoms	α & β helix
Tertiary	3D arrangements of peptide chains	
Quarternary	Multiple interacting peptide chains/subunits	*subunits = cooperative bonding

CLASSIFICATION OF PROTEINS

By Shape	**1. Globular**	Water soluble; plasma proteins	**2. Fibrous**	Water insoluble, structural proteins
By Composition	**1. Simple**	Amino acid only	**2. Conjugated**	Amino acid + Non Amino Acid
By Function	**1. Structural**	Collage, keratin, eslastin	**4. Regulatory**	Hypothalamic, Pituitary and Pancreatic Hormones
	2. Transport	Hgb (O_2), Ceruplasmin (Cu)		
	3. Storage	Myoglobin	**5. Defense**	Immunoglobulins
			6. Catalytic	Enzymes

C. ENZYMES

THEORIES OF BINDING

Lock & Key theory	Only 1 substrate; Rigid active site
Induce fit	Active site can change conformation (flexible)

Enzymes rarely work alone → need assistance of co-factor

Entire Enzyme (holoenzyme) ● → ◖ Protein (apoenzyme) → ◗ Nonprotein (cofactor)	a. Inorganic – Metal ions Zn^{+2} → Carbonic anhydrase Fe^{+2} → Catalase Mg^{+2} →Hexokinase	b. Organic – come from B vitamins B_2 → NAD^+ B_3 → FAD^+ / FMN^+ B_5 → CoA "coenzymes"

CLASSIFICATIONS

OTH LIL

EC #1	**Oxidoreductase**	Oxidase, Reductase, Dehydrogenase	EC #4	**Lyase** *heterogenous * usually removes fxnal grp	Deaminase → removes NH_2 Decarboxylase → remove COOH (as CO_2) Anhydrase/Dehydratase → remove H_2O
EC #2	**Transferase**	Kinase - transfers PO_4			
EC #3	**Hydrolase** *usually L word enzyme	Urea, Lipase, Protease, Nuclease, L-asparaginase, Acetylcholinesterase	EC #5	**Isomerase**	Isomerase, Epimerase, Mutase, Racemase
			EC #6	**Ligase** (condensation)	Synthase, Syntethase, Carboxylase

ENZYME KINETICS

Michaelis Menten plot

Km → required to reach ½ max
→Reflects the affinity o the enzyme

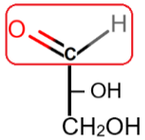
Factors affecting Enzyme Kinetics:

1. Temperature
2. pH

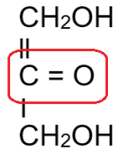
Enzyme Inhibition

	Km	Vmax
Competitive	↑	**Same**
Noncompetitive	**Same**	↓
Uncompetitive	↓	↓

II. CARBOHYDRATES



Aldehyde
RCHO
*end



Ketone
RCOR
*middle

CLASSIFICATIONS

1-unit	Monosaccharide				**2-unit**	Oligosaccharide
a. Functional grp:	i. Aldose (ex. ribose)		ii. Ketose (ex.ribulose)		Maltose	Glucose + Glucose
b. # of carbons	**Aldose**		**Ketose**		Sucrose	Glucose + Fructose
3	Trioses	Glyceraldehyde	Triulose	Dihydroxyacetone	Lactose	Glucose + Galactose
4	Tetrose	Erythrose	Tetrulose	Erythrulose	**>10 units**	Polysaccharide → often structural / storage
5	Pentose	Ribose	Pentulose	Ribulose	Structural - cell wall components	Plant - cellulose; Fungi - chitin
6	Hexose	Glucose	Hexulose	Fructose	Storage - stored energy	Plant - starch; Animal - glycogen

- **Linear** = Fischer projection
  *penultimate – 2nd to the last Carbon
- **Cyclic** = Hayworth projection
  *involves attachment of the penultimate O to the Carbonyl C

ISOMERISM

Epimers	Differ only 1 chiral carbon
Enantiomers	All chiral carbons are inverted
Diastereomers	Etc./ between Epi & Enantiomer
Anomer	Differ @ carbon #1 only (α & β)

REACTIONS:

Oxidation	Condensation
Reduction	

Most common sugars are **reducing**
except Sucrose & Trehalose
Also differentiates mono (fast) & di (slow) ←

QUALITATIVE TESTS

	Test for	Reagent	Result
Molisch test	General test	α-napthol	(+) violet
Seliwanoff test	Ketoses	Resorsinol	(+) cherry red
Iodine test	Starch	I_2 solution	(+) blue/violet
Osazone test	Lac, Mal/Suc, Glu/Fru/Man	Phenylhydratazone	(+) crystals
Bial's test	Pentoses	Orcinol	(+) green
Mucic acid test	Galactose	HNO_3	(+) crystals
Tollen's test	Reducing sugars	Ammoniacal $AgNO_3$	(+) Silver Mirror
Fehling's test	Reducing sugars	$CuSO_4$	(+) brick red ppt.
Benedict's test			
Barfoed's test			

III. LIPIDS

FATTY ACIDS

Saturated → No C=C				**Unsaturated** → C=C	
Caproic	6	**P**almitic	16	**P**almitoleic	16
Caprilic	8	**S**tearic	18	**O**leic	18
Capric	10	**A**rachidic	20	**L**inoleic	18
Lauric	12	**B**ehemic	22	**L**inolenic	18
Myristic	14	**L**ignoceric	24	**A**rachidonic	20

Reaction of Lipid

1. Saponification
2. Auto-oxidation/ Rancidification
3. Hydrogenation/Reduction

QUALITATIVE TESTS

	Test for	Reagent	Result
Lieberman-Burchard	Sterols	H_2SO_4 + Acetic Anhydride	(+) green
Acrolein Test	Glycerol	$KHSO_3, \Delta$	(+) burnt fat odor
	Phosphate	Ammonium molybdate	(+) yellow ppt

SAPONIFIABLE LIPIDS

1. Triacylglyecrol				
2. Phospholipids		X =		
		H	Phosphatidic acid	
		Choline	Phosphatidylcholine "Lecithin"	
		Ethanolamine	Phosphatidylethanolamine "Cephalin"	
		Inositol	Phosphatidylinositol	
3. Sphingolipids		X =		
		H	Ceramide	
		Glu or Gal	Cerebroside	Glyco-sphingo-lipids
		Oligosacch	Globoside	
		Oligosacch w/ sialic acid	Ganglioside	
		Choline + PA	Sphingomyelin	Sphingo-phospholipid
4. Waxes				

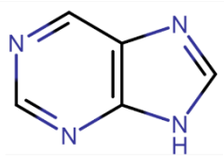
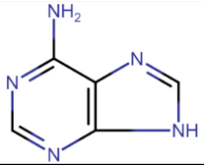
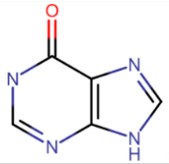
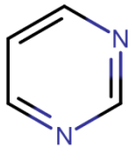
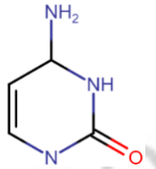
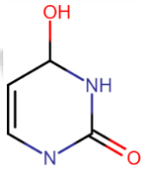
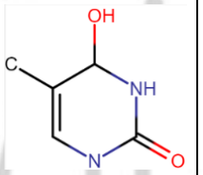
NON-SAPONIFIABLE LIPIDS

1. Fat Soluble vitamins	A	Eyesight	E	antioxidant
	D	Not true vit.	K	Coagulation
2. Terpenes 1Terpene = 10C	10	Monoterpene	30	Triterpene
	15	Sesquiterpene	40	Tetraterpene
	20	Diterpene		
CHOLESTEROL	→ C_{27} compound; contains *CPPP* nucleus CycloPentanoPerhydroPhenanthrene			

IV. NUCLEIC ACIDS

Central Dogma	DNA	Replication →→→	DNA	Transcriptions →→→	RNA	Translation →→→	PROTEINS

NUCLEOTIDE STRUCTURES

	**Purine** (PurGA)		Adenine		Guanine		
	**Pyrimidine** (PyrCUT)		Cytosine		Uracil		Thymine

REPLICATION

- DNA Synthesis
- Semi-conservative
- Semi-discontinous

- Bidirectional
- Has high fidelity /accuracy
- DNA → DNA

Steps:

Initiation

1. DNA double helix is opened by helicases
2. Primase creates a temporay RNA primer for each DNA strand

Elongation

3. DNA polymerase at the replication fork synthesize DNA in 5' to 3' direction. There are two strands, the leading & lagging strands.
4. DNA polymerase removes RNA primer & fills the gaps between the Okazaki fragments
5. DNA ligase joins DNA fragments of the lagging strand, creating a single DNA molecules

Helicases	→ unwind double stranded-DNA
Topoisomerase	→ relieve super coiling prevent the breaking of DNA
Primase	→ required in the synthesis of the RNA primers

DNA polymerase

I	only one to remove DNA primers
II	involve in DNA repair
III	responsible for the synthesis of Okazaki fragment
DNA ligase	connect the okazaki fragments

LEVELS OF ORGANIZATION

Primary	→ Sequence of nucleotide; linear
Secondary	→ Involves pairing via the H-bonds *coiling INTERstrand (DNA) INTRAstrand (RNA)
Tertiary	→ Further organization Ex. Supercoiling, plasmid
Quartenary	→ Involves nucleoprotein complex Ex. Histones

DOUBLE HELIX

1. Complementary base-pairing
   AT (2bonds) CG (3bonds)
2. Helical/handed
   CW = right handed (A-DNA,B-DNA)
   CCW = left handed (Z-DNA)
3. Antiparallel (5'→ 3') (3'←5')

TRANSCRIPTION

- RNA synthesis **C = G** **A = U**
- synthesis of DNA → mRNA

- Unidirectional
- Lower fidelity

- process by which the genetic messages contained in DNA are "read", or transcribed, & carried out of nucleus to parts of the cell called ribosomes where protein synthesis occurs

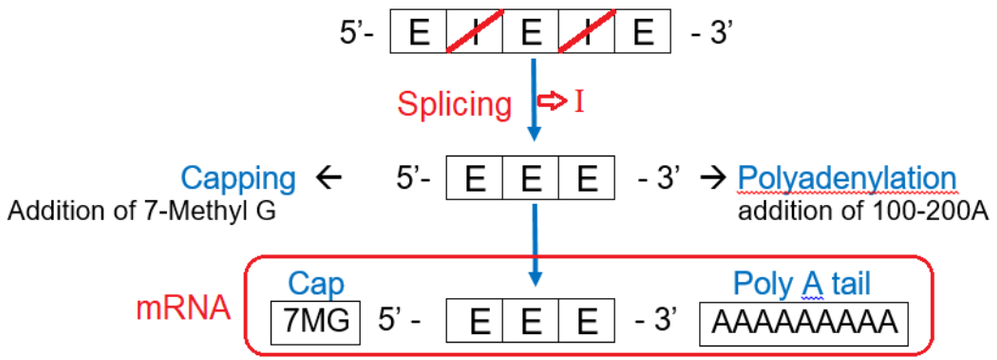
RNA Polymerase	→ main enzyme; has 2 subunits: **sigma & core** → can initiate polymerization
mRNA	→ act as template for translation (synthesis of protein) → carrier of codons
tRNA	→ adaptor molecule of amino acid → carrier of anticodon **Types:** (2) Charged (w/ AA), Uncharged (w/o AA)
rRNA	→ together w/ other proteins make up the ribosomes

Steps:

1. **Initiation:** Once RNA polymerase binds with +1, process of unwinding starts and sigma subunit is released
2. **Elongation** (by core subunit)
   Template Strand → Antisense
   Non-Template / Information Strand → Sense
3. **Termination:**
   Rho-dependent → Termination sequence
   Rho-independent → Palindrome sequence then hairpin loop

Product: pre-mRNA

POST-TRANSCRIPTIONAL MODIFICATIONS



TRANSLATION

- protein synthesis
- mRNA → protein

3 bases : 1 amino acid

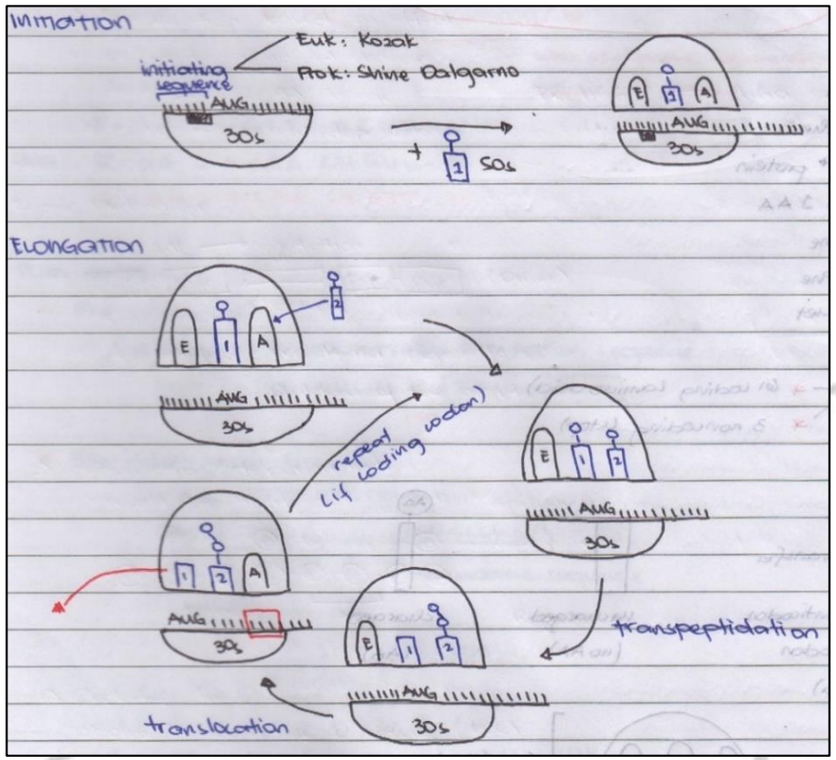
Codons ↓
- UUU – Phe
- UUC – Phe
- AUG – Met (start)

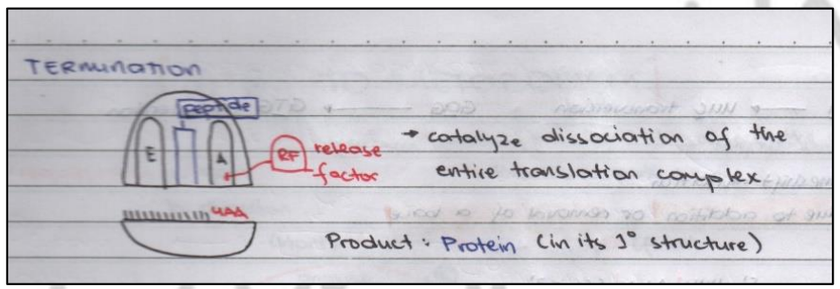
64 codons → 61 coding (amino acid)
→ 3 non coding (stop)
UAG, UGA, UAA

AAA anticodon UUU codon

RULES OF THE GENETIC CODE

1. Universal	
2. Degenerate/ redundant	1 Amino acid ~ many codons except Methionine (AUG), Tryptophan (UGG)
3. Non-ambigous	1 codon = 1 amino acid
4. Non-overlapping	
5. Coma less, no skips	5'- UUU | AAA | GGG - 3'





POST TRANSLATIONAL MODIFICATION	
1. Folding	→ Interactions toward the protein's native state → Sometimes requires use of chaperone proteins
2. Side chain modificaiton	→ Removal of AA's or addition of fxnal grps
3. Targeting	→ By glycosylation → In ER / golgi apparatus
4. Degradation	→ By proteasomes → Common: Ubiquination

MUTATIONS	
→ alteration in the gene sequence	→ often lead to disease

SMALL MUTATIONS:				
Point Mutation	→ due to substitution of a single base			
	Transition	Pur → Pur ; Pyr → Pyr		
	Transversion	Pur → Pyr ; Pyr → Pur		
Frameshift Mutation	Due to addition or removal of base			
Classification base on effect	Silent	No AA change	Non-sense	New stop codon
	Missense	AA change		

REPAIR MECHANISM		
Excess UV → mutation	↓ photolyase – Xeroderma pigmentosa	
Depurination/ Depyrimidation	Result to AP site	Repair: excision repair
Oxidative stress	Due to reactive O species (ROS) Uncontrolled death	Prevention: Anti-oxidants Endogenous glutathione

IDENTIFICATION TEST			
	Identification of	**Reagent**	**Positive result**
PROTEINS			
Xanthoproteic test	Phenylalanine	HNO_3	Yellow / Orange
Lead acetate test	Methionine	Thioether	Black
Hopkin's Cole	Tryptophan	Glyoxylic acid	Violet ring
Ninhydrin	Proline		Violet 1° except proline 2°
Nitroprusside	Cysteine		Red
Millon's test	Tyrosine	Hg^{2+}	Pink / rose
Pauly test	Histidine	Diazotized sulfanilic acid	Red
Sakaguchi test	Arginine	α-napthol	Red
Molisch test	Carbohydrates (general)	α-napthol	Violet
Iodine test	Starch	I_2 sol'n	Blue/Violet
Bials test	Pentoses	Orcinol	Green
Seliwanoff's test	Ketoses	Resorcinol	Cherry red
Osazone test	Lac/ Mal/ Suc/ Glu/ Fru/Man	Phenylhydrazine	Crystals
Mucic test	Galactose	HNO_3	Crystals
Tollen's test	Reducing sugar	Ammoniacal $AgNO_3$	Silver mirror
Fehling's	Reducing sugar	Cu^{+2} SO_4	Brick red ppt
Benedict's			
Barfoed's			
Barfoed's	Differentiate mono & di		Mono (fast), Di (slow)
*Most common sugars are REDUCING SUGARS except Sucrose & Trehalose			
LIPIDS			
Lieberman-Burchard	Sterols	H_2SO_4 + acetic anhydride	Green
Acrolein test	Glycerol	$KHSO_3$	Burnt fat odor
	PO_4	Ammonium molybdate	Yellow ppt

Additional Notes

	INSULIN	GLUCAGON
End effect	↑ BS	↓BS
Timing	Fed	Fasted
Glycolysis	✓	×
Gluconeogenesis	×	✓
Glycogenesis	✓	×
Glycogenolysis	×	✓

Processes occurs at:	
Mitochondria	TCA, ETC, B-oxidation, Ketogenesis
Cytosol	Glycolysis, Glycogen metabolism, PPP, FA synthesis, Cholesterol synthesis
BOTH "HUG takes 2"	Heme synthesis, Urea cycle, Gluconeogenesis

RATE LIMITING STEPS	
Glycolysis	Phosphofructokinase
Gluconeogenesis	Fructose 1,6-Biphosphatase
Kreb's cycle	Isocitrate Dehydrogenase
Glycogenesis	Glycogen synthase
Glycogenolysis	Glycogen phosphorylase
Pentose Phosphate Pathway	Glucose-6-Phosphate dehydrogenase
Fatty Acid Synthesis	Acetyl CoA Carboxylase
B-oxidation	Carnitine acyl transferase
Ketogenesis	HMG CoA Reductase
Urea cycle	Carbamoyl-P-Synthethase

AMINOACIDOPATHIES	
Phenylketonuria	Deficiency on phenylalanine hydroxylase (Phe-Tyr)
Maple Syrup Disease	Branched chain alpha keto acid dehydrogenase (increase L,I,V)
Alkaptonuria	Hemogentisate oxidase (AKA Black urine disease)
Albinism	Tyrosinase (decrease melanin)

METABOLISM		
Carbohydrate	Glycolysis	Gluconeogenesis
	Glycogenesis	Glycogenolysis
	Kreb's Cycle	Electron transport chain
Lipid	Fatty Acid Synthesis	Fatty Acid Oxidation
	Mevalonate Pathway (MEV)	Methylerythriol Pathway (MEP)
	Ketogenesis	

TERPENES

Name	#C	# of isoprene	Example	
Monoterpene	10	2	Most volatile oils e.g. geraniol, citral, menthol	
			Limonene	Most common
Sesquiterpene	15	3	Parthenolide	Serotonin antagonist
			Quinghaosu	*Artemisia annua*
Diterpene	20	4	Paclitaxel	*Taxus brevifolia*
			Forksolin	
			Zingiberol	
Triterpene	30	6	Neem	*Azadirachta indica*
Tetraterpenes	40	8	Retinol	
			Lycopene	

DEFICIENT ENZYMES

GLYCOGEN STORAGE DISEASE

Type	Name	Enzyme	
O		Glycogen Synthase	
Ia	Von Gierke	Glucose-6-Phosphatase	Von GP
Ib		Glucose-6-Ptranslocase	
II	Pompe	Lysosomal α (1,4) glucosidase	PomLy
III	Cori	Debranching enzyme	CD
IV	Andersen	Branching enzyme	AB
V	McArdle	Muscle glycogen phosphorylase	Muscleman = McArdle
VI	Hers	Hepatic glycogen phosphorylase	HeHe
VII	Tarui	Phosphofructokinase-1	TauFru

AMINO-ACID DERIVATIVE PRODUCTS

Tyrosine	Catecholamine	Thyroid hormones
	Melanin	
Tryptophan	Serotonin	Melatonin
Histidine	Histamine	
Serine	Choline	
Glutamate	GABA	
Glycine	Heme synthesis	
Argine	Nitrous Oxide	
Glycine	Heme synthesis	
Argine	Nitrous Oxide	

MUCOPOLYSACCHARIDOSIS

Type	Name	Deficient Enzyme
IH	Hurler	α-L iduronase
IS (Formerly V)	Scheie	
IH/S	Hurler-Scheie	
II	Hunter	Iduronate sulfatase
IIIA	San Filippo Syndrome	Heparan Sulfatase
IIIB		N-acetylglucosaminidase
IIIC		Glucosamine-N-acetyltransferase
IIID		N-acetylglucosamine-6-sulfatase
IVA	Marquio Syndrome	N-acetylgalactosamine-6-sulfatase
IVB		B-galactosidase
VI	Maroteaux-Lamy	N-acetylgalactosamine-4-sulfatase
VII	Sly Syndrome	B-glucuronidase
IX	Natowicks Syndrome	Hyaluronidase

LYSOSOMAL STORAGE DISEASE

Tay-Sachs	Hexosaminidase A	TaySax
Sandhoff	Hexosaminidase A & B	A & B
Fabry	α-galactosidase A	Fabulous Alpha-Gal
Krabbe	β-galactosidase	ab
Gaucher	B-glucosidase	U
Metachromatic Leukodistrophy	Arylsulfatase	
Nieman-Pick	Sphingomyelinase	No man pick's his nose w/ his finger
Farber	Ceraminidase	Cerafarber

CARBOHYDRATE METABOLISM

A. GLYCOLYSIS

- Breakdown of glucose of 2 molecules of pyruvate
- Occurs in the cytosol
- Universal
- Effect: ↓ Blood Sugar
- Timing: Fed
- (+) insulin
- Consist of 10 steps: (a) energy investment (1-5)
  (b) energy pay-off (6-10)

1. (-1) GLUCOSE

ATP / ADP ↓ **Hexokinase (HK)**

2. **Glucose - 6 - Phosphate**

↓↑ **Phosphoglucoisomerase**

3. **Fructose - 6 - Phosphate**

ATP / ADP ↓ **Phosphofructokinase (PFK)**

4. (-1) **Fructose - 1,6 - bisphosphate**

Aldolase

Dihydroxyacetone Phosphate (DHAP) ⇄ 5. Triose Phosphate isomerase ⇄ **Glyceraldehyde-3-Phosphate (G3P)**

6. 2NAD / 2NADH ↓↑ **G3P-dehydrogenase**

Energy yield:
- 2 ATP/glucose
- 2 NADH

2x **1,3-biphosphate glycerate**

7. (+2) 2ATP / 2ADP ↓↑ **Phosphoglycerate kinase**

2x **3-phospoglycerate**

3 Irreversible reactions
- Hexokinase
- Phosphofructokinase
- Pyruvate kinase

8. ↓↑ **Phosphoglycerate mutase**

2x **2-phospoglycerate**

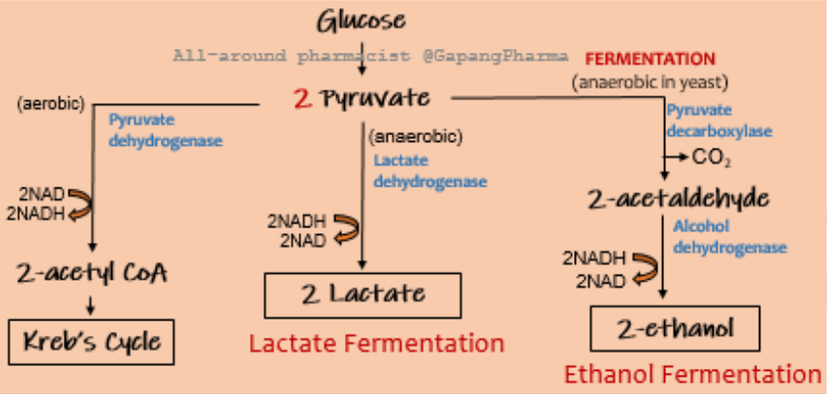
9. ↓↑ **Enolase**

2x **Phosphoenol pyruvate**

10. (+2) 2ATP / 2ADP ↓ **Pyruvate kinase (PK)**

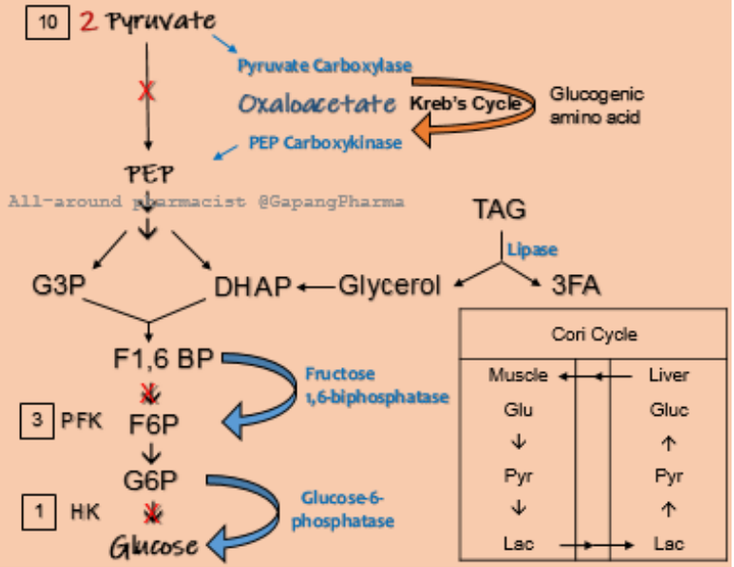
PYRUVATE

B. Fates of Pyruvate

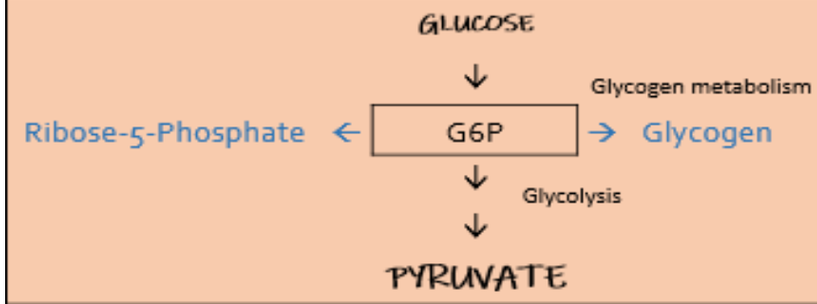


C. GLUCONEOGENESIS

- Conversion of non-carbohydrates to glucose
  (pyruvate, amino acids, glycerol, lactate)
- Localized in the liver
- Effect: ↑ Blood Sugar
- Timing: Fasted state
- Similar to reverse glycolysis



D. OTHER FATES OF GLUCOSE 6 PHOSPHATE

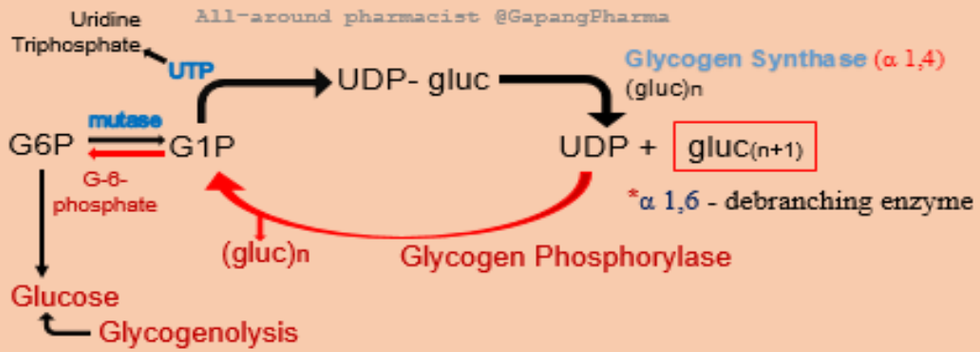


1. Glycogen Metabolism

- Glycogen stores in liver and muscle
  → A homopolysaccharide (glucan)

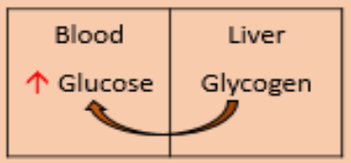
a. Glycogenesis

- Glycogen synthesis
- Effect: ↓ Blood sugar
- Timing: Fed state
- (+) insulin



b. Glycogenolysis

- Breakdown of glycogen
- Effect: ↑ Blood sugar
- Timing: fasted
- (+) glucose



2. PENTOSE PHOSPHATE PATHWAY

- Aka Hexose Monophosphate Shunt

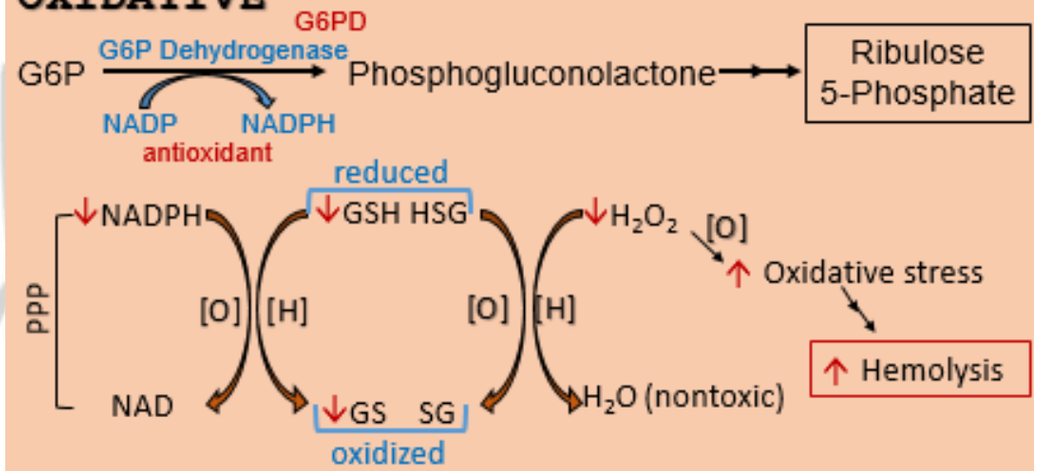
Glucose-6-Phosphate → Ribose-5-Phosphate

NADH

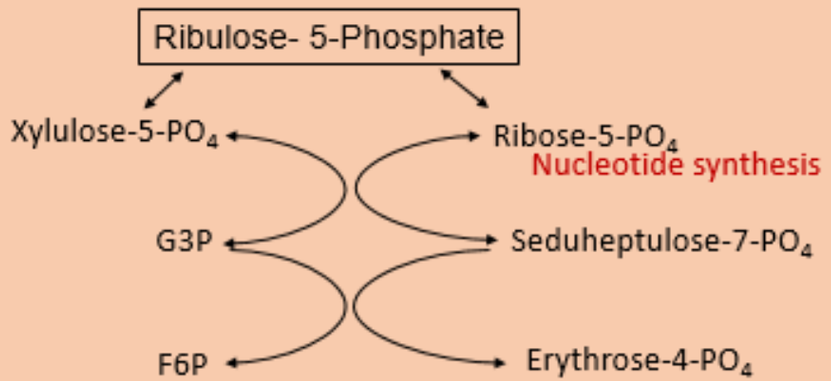
Target Products:
- Ribose-5- Phosphate
- NADPH

Phases:
- Oxidative
- Non-oxidative

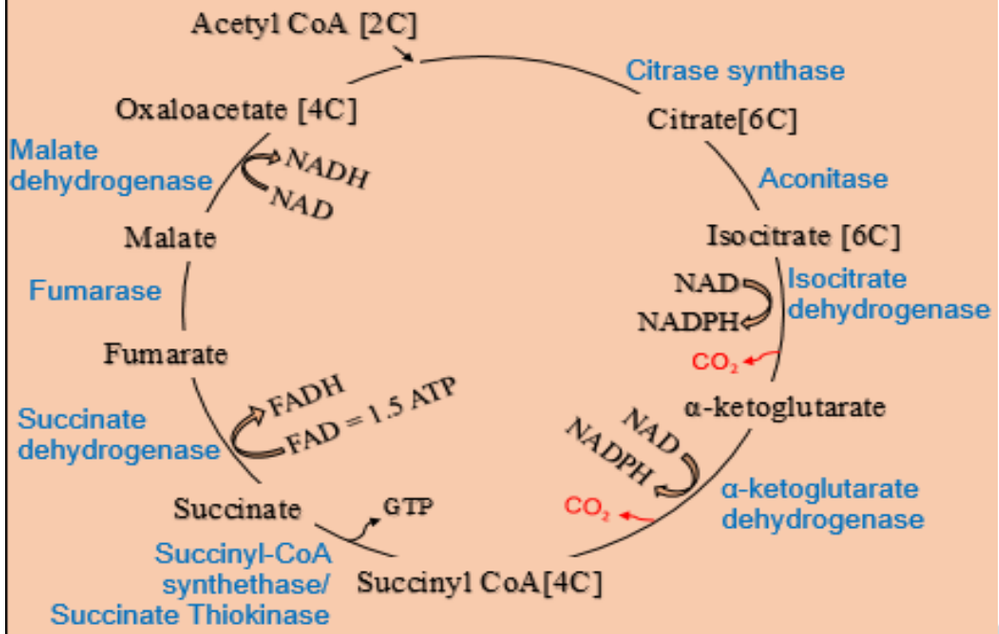
OXIDATIVE



NON OXIDATIVE

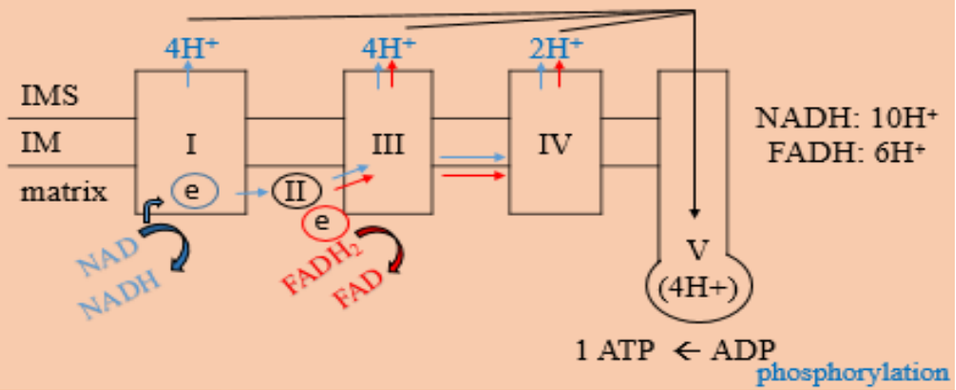


E. Kreb's Cycle



OAA	Goes thru gng
α-kg	Used in the transamination/catabolism of AA's
Succinyl CoA	Used in heme synthesis

F. ELECTRON TRANSPORT CHAIN



LIPID METABOLISM

A. FATTY ACID SYNTHESIS

- Anabolic
- Occurs in cytosol
- Triggered by the fed state/ high carb intake
- (+) insulin

(2C) Acetyl-CoA + Malonyl CoA (3C)
→ CO_2
(4C) Butyryl-CoA + Malonyl CoA (3C)
→ CO_2
Caproyl CoA (6C)
repeat
Palmitoyl-CoA (16C)

Palmitoyl-CoA (16C)
a. Released as FFA
b. Modified by lengthening (uncommon)
c. Used to make TAGs/ PLs

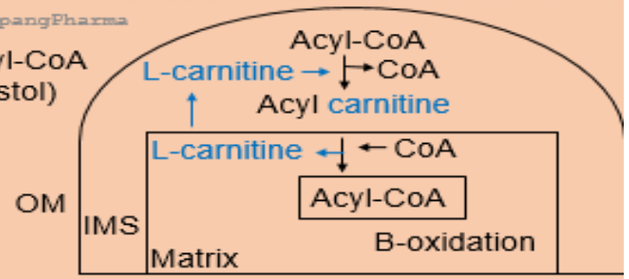
B. FATTY ACID OXIDATION

- B-oxidation
- Requires fasted state
- (+) Glucagon

TAG
Glycerol → Gluconeogenesis
FAs → B-oxidation

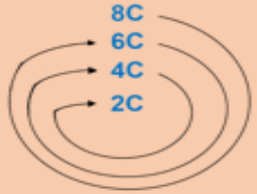
- Occurs in the mitochondrial matrix

Fatty Acid —(+ CoA, -2 ATP)→ Acyl-CoA (cystol)

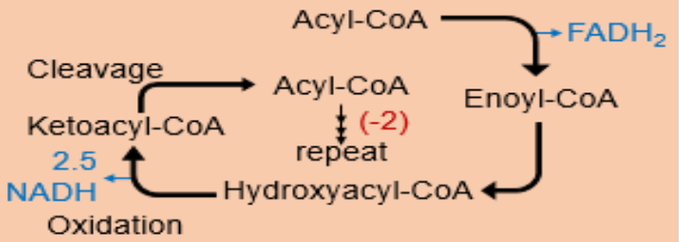


B-oxidation

Involves successive 2C removals in the fatty acid (as Acetyl CoA)



Cycle/Spiral
4 ATP per cycle



Mevalonate Pathway

- One of the fates of HMG-COA
- Cystolic
- Triggered by fed state

Acyl-CoA → Hydroxymethyl-glutaryl-CoA (HMG-CoA)

(fasted) → Ketogenesis → Acetoacetate → acetone + B-hydroxyl butyrate

(fed) → Statin ⊣ HMG CoA (RLS) Reductase → Mevalonate

Mevalonate Pyrophosphate

Dimethylallyl Pyrophosphate (DMAP) [5C] ⇌ Isopentenyl Pyrophosphate (IPP) [5C]

Geranyl PP [10C] → Monoterpene

↓ + 1 PP

Forsenyl PP [15C] → Sesquiterpene (ex. Artemisin)

↓ Universal x2

Some plants +1PPP → Geranyl geranyl PP [20C] → Diterpene (ex. Paclitaxel)

Squalene [30C]

↓ 20+ steps

Sterols

*MEP (Methylerythriol)

Ketogenesis

- Synthesis of Ketone bodies

1. Acetoacetate
2. Acetate
3. B-hydroxybutyrate ← Depends on ketones

- The brain cannot use fats even during the fasted state
- Triggered by extended periods of fasting

→occurs along side B-oxidation

OTHER PATHWAYS

A. Pyrimidine/Folate Metabolism (de novo)

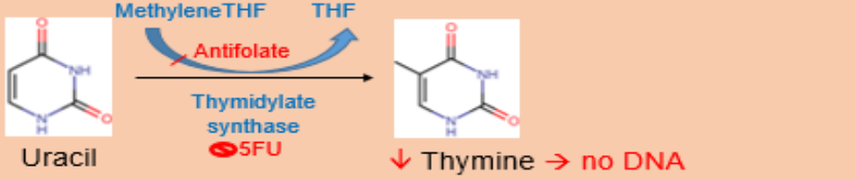
5 Steps

Parent Pyrimidine ← Orotidine Monophosphate

↓ UMP [H]

UTP → Cytidine Triphosphate CTP

dUMP → dTMP



PABA + Dihydropteroate → (Dihydropteroate synthetase) Dihydrofolate → Tetrahydrofolate (active)

Sulfonamide | Trimetophrim

Antifolate

B. Purine Metabolism (de novo)

11 Steps

Inosine Monophosphate (IMP) → Parent Purine

Adenylosuccinate → AMP

Xanthosine monophosphate → GMP

DEGRADATION

AMP → Adenine → hypoxanthine

GMP → Guanine

AMP + GMP → R5P → IMP/GMP

hypoxanthine → Xanthine ← Guanine (or)

Xanthine → [Uric acid]

Allopurinol / Febuxostat ⊣ Xanthine Oxidase

↑ UA = Gout

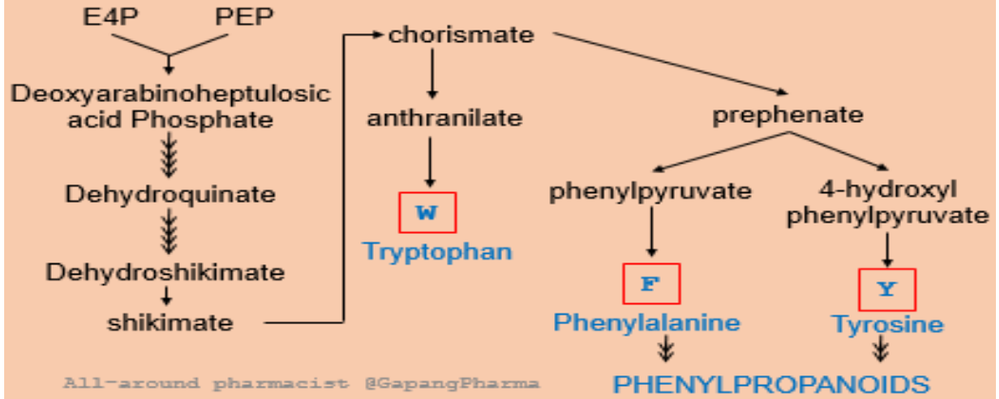
IMP/GMP → Hypoxanthine Guanine Phosphoribosyltransferase (HGPRT)

6-thioguanine

6-mercaptopurine

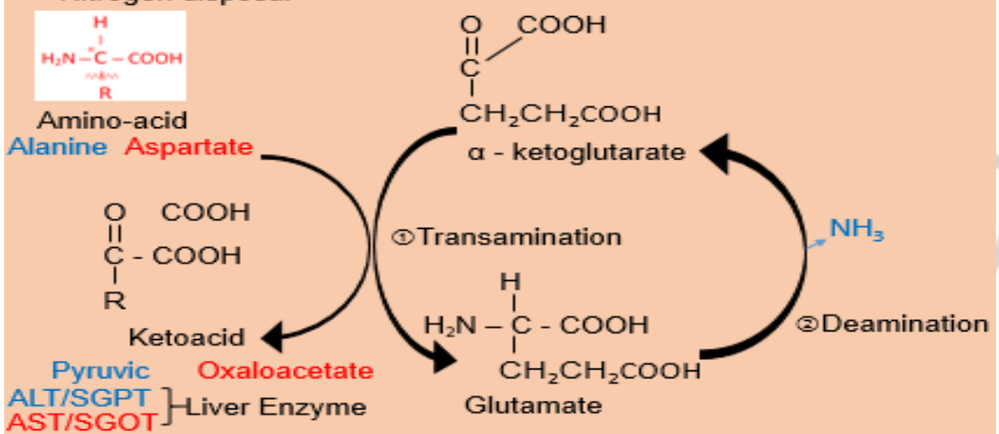
C. Shikimic Acid Pathway

Synthesis of Aromatics & Polyphenols

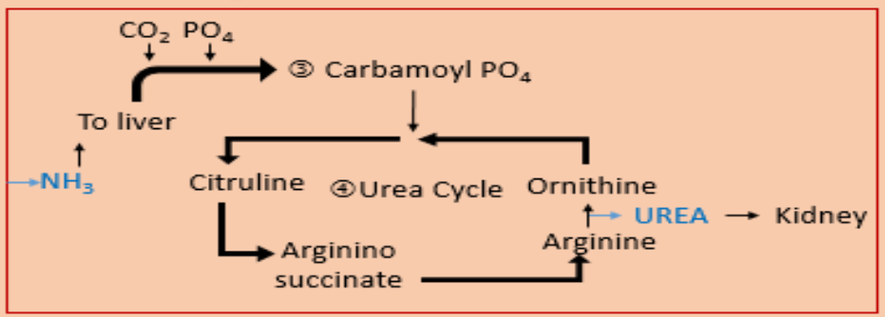


D. Transamination & Urea Cycle

Nitrogen disposal



D. Urea Cycle

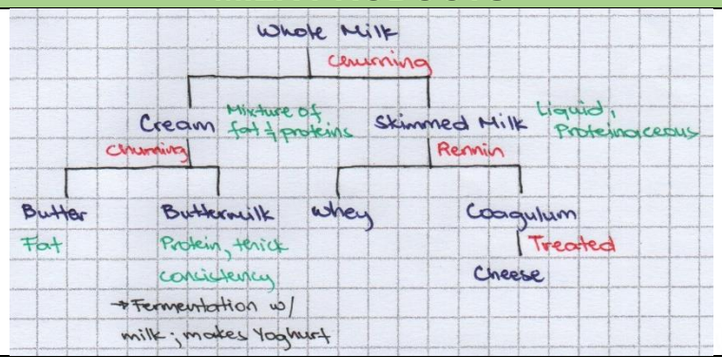


PHARMACOGNOSY

Plant Family

Old Name	New Name	
Labitae	Lamiaceae	
Compositae	Asteriaceae	Astra composes
Unbelliferae	Apiaceae	Unbeliaple
Leguminaseae	Fabaceae	LegumFaba?
Crussiferae	Brassicaceae	CB
Graminae	Poaceae	Poe wins grami
Guttiferae	Glussiaceae	GG
Palmae	Arecaceae	PalmAre

MILK PRODUCTS



TAXONOMY

Domain	Order
Kingdom	Family
Phylum	Genus
Class	Species

"Dumb Over Kids Fancy Prefer Green Candies Salads"

CARBOHYDRATES

MONOSACCHARIDE

Test: Benedict's & Barfoed's = (+) Brick red ppt

#C		Aldose (-ose)	Ketose (-ulose)
2	Diose	Hydroxyacetaldehyde	
3	Triose	Glyceraldehyde	Dihydroxyacetone
4	Tetrose	Erythrose	Erythrulose
5	Pentose	Ribose, Xylose, Arabinose Test: Bials, Benzidine	Ribulose, Xylulose
6	Hexose	Glucose, Galactose Test: Mucic & Phenylhydrazine	Fructose Test: Seliwanoff
7	Heptose		Sedoheptulose
8	Octase		D-glycero-D-mannoctulose
9	Nanose		Neurominic (Salic acid)

DISACCHARIDE

Non-reducing			Reducing		
Sucrose	Gluc + Fruc	α 1,2	Maltose	Glucose + Glucose	α 1,4
Trehalose	Gluc + Gluc	α 1,1	Lactose	Glucose + Galactose	β 1,4
			Lactulose	Fructose + Galactose	β 1,4

OLIGOSACCHARIDE

1. Maltotriose	Gluc + Gluc + Gluc	4. Raffinose	Gluc + Galac + Fruc
2. Dextrin		5. Stachylose	Gluc + Galac + Galac + Fruc
3. Gentianose	Gluc + Gluc + Fruc		

POLYSACCHARIDE

HOMOGLYCAN

	Amylose	Amylopectin
	β-amylose	α-amylose
Structure	Linear/helical	Branched
	250-300 units (α 1,4)	1000 or more (α 1,6,α 1,4)
Sol in H_2O	Insoluble	Soluble
Iodine test	Deep/dark blue	Blue violet/Purple

1. Starch

Corn	*Zea mays*	2. Cellulose	Hair seeds of Cotton	*Gossypium hirsutum*
Wheat	*Triticum aestivum*			
Potato	*Solanum tuberosum*	3. Inulin	Chicory root	*Chicorium intybus*
Rice	*Oryza sativa*			
Arrow Root	*Maranta arundincea*			

HETEROGLYCAN

GUMS & MUCILAGES

	Other Name	Botanical Origin
▪ SHRUB & TREE EXUDATES		**Ka-GhAT**
Karaya	Sterculia Gum	*Sterculia urens*
Ghatti	Indian Gum	*Anogiessus latifolia*
Acacia	Gum Arabic	*Acacia senegal*
Tragacanth	Gum Tragacanth	*Astralagus gummifer*
▪ MARINE GUM		**ACADs**
Agar	Japanese Isinglass	*Gelidium cartilageneum*
		Gracilaria confervoides
Carageenan	Irish moss	*Gigartina mamillosa*
	Red algae	*Chrondrus crispus*
Algin	Brown seaweed	*Macrocystis pyrifera*
Danish Agar	Furcellaran	*Furcellaria fastigiata*
▪ SEED GUM		**PiCyLo-Guar**
Psyllium		*Plantago psyllium*
		Plantago ovata
Cydonium	Quince seed	*Cydonia vulgaris*
Locust Bean Gum	Carob Pulp	*Ceratonia siligua*
	St. John's Bread	
Guar gum	Guaran	*Cyamopsis tetragonolobus*
▪ MICROBIAL GUM		**XD**
Xanthan Gum		*Xanthomonas campestris*
Dextran		*Leuconostoc mesenteroides*
▪ PLANT EXUDATE		**Pectin**

Pomelo	*Citrus grandis*	Calamansi	*C.microcarpa*
Orange	*C. aurantum*	Grape fruit	*C. paradise*
Dalanghita	*C. nobilis*	Lemon	*C.limon*
Ponkan	*C. sinensis*	Apple	*Pyrus malus*

▪ STARCH & CELLULOSE DERIVATIVES

GLYCOSIDE

FlaPheIsoCLaSa AlAnAlCaT

ApAdBlaCoCaDiSquiStro

▪ CARDIAC

Unsaturated steroidal aglycone tests		2-deoxysugar glycone test	
Liebermann-Burchard (+) blue-green (unsaturated) (-) yellow (saturated)	Salkowski (+) red ring at junction	Keller-Killiani	reddish brown
		Baljets	
		Legal's	

	Constituent	Other Name	Botanical Origin
Apocynum	Cymarine	Dogbane/ Black Indian Hemp	*Apocynum cannabinum*
Adonis	Adonitoxin	Pheasant's eye	*Adonis vernaliz*
Black Hellebore	Hellebrin	Christmas Rose	*Helleborus niger*
Convallaria	Convallotoxin	Lily of the Valley	*Convallaria majalis*
Cactus Grandiflorus	Queen of the Night	Night blooming cereus	*Selenereus grandiflorus*
Digitalis	Digitoxin	Fox glove	*Digitalis purpurea*
	Digoxin	Grecian foxglove	*Digitalis lanata*
Squil bulb	Sullarenin	Mediterranean/ White	*Urginea maritima*
		Indian	*Urginea indica*
Strophantus			*Strophantus kambe*
			Strophantus hispidus
			Strophantus gratus
			Acokanthera shimpera

Maroon – notes as source
Additional from other source

▪ ANTHRAQUINONE			AnFRaCChrynoneS
(+) Borntrager's test		Aglycone: Anthracene *catharthics	
	Constituent	Other Name	Botanical Origin
Aloe / Sabila	Barbaloin, Isobarbaloin, Aloin, Aloe emodin	Curacao Aloe	*Aloe barbadensis*
			Aloe vera
		Cape Aloe	*Aloe ferox*
			Aloe africana
			Aloe spicata
Frangula		Buckthorn bark	*Rhamnus frangula*
Rhubarb	Rhein anthrones	Chinese	*Rheum officinale*
			Rheum palmatum
		Indian	*Rheum emodi*
			Rheum webbianatum
		Ornamental	*Rheum rhaponatum*
Chrysarobin			*Andira araroba*
Cascara sagrada	Cascaroside A,B,C,D		*Rhamnus purshianus*
Senna	Sennoside A,B,C,D	Alexandria	*Cassia acutifolia*
		Tinnevelly	*Cassia angustifolia*

▪ CYANOPHORIC	(+)Guignard Test = Brick red		
Wild Cherry	*Prunus serotina*	Apricots	*Prunus armeniaca*
Bitter almond	*Prunus amygdalus*	Barley	*Hordeum vulgare*

▪ ISOTHIOCYANATE		Isothiomustard
	Constituent	Botanical Origin
Black mustard	Allyl	*Sinapis nigra* Populus spp.
White mustard	Acrinyl	*Sinapis alba*

▪ ALCOHOL	Aglycone: Saligenin	Drink Alcohol to WiPo
Willow bark	*Salix purpurea*	
	Salix fragilis	
Poplar bark	Populus spp.	

▪ SAPONIN		GlyGiDi AgSiSt
(+) Froth Test	Hemolysis Test	Aglycone: Sapogenin
	Capillary Test	Lieberman-Burchard Test
	Constituent	Botanical Origin
Glycirrhiza / Licorice	Glycyrrhizin, Glycirrhizic acid	Spanish *Glycirrhiza glabra*
		Russian *Glycirrhiza glabra v.glandulifera*
Ginseng	Panaxoside, Gensenoside Chikuse/ Susaponin	American *Panax quinquefolus*
		Asian *Panax ginseng*
Dioscorea	Diosgenin, Botogenin, Hecogenin	*Dioscorea spiculifora*
		Dioscorea floribunda
Agave	Fiber, Hecagenin Manogenin Gifogenin	*Agave cantalla*
Similax	Smilagenin	*Smilax aspera*
Strophantus	Sarmantogenin	* See cardiac gly

▪ FLAVONOL	Aglycone: Flavonoids	Gink Milk to Elin
Abundant in: Polygoneceae, Rutaceae,Umbelliferae		
	Constituents	Botanical Origin
Bioflavonoids from Citrus and Soya	Rutin & Hisperidin; Hesperitin; Diosmin;	Citrus fruits
		Glycine max
		Glycine soja
Gingko	Ginkolides, Bilobalides	*Gingko biloba*
Milk Thistle	Silibinin,Silymarin	*Silybinum marianum*
Elin	Quercitin	

▪ ALDEHYDE		Vanillaldehyde
Vanilla	Mexican vera cruz	*Vanilla plantifolia*
	Bourbon vanilla	
	Tanitian vanilla	*Vanilla tanitensis*

▪ PHENOL			PUP
	Other Name	Constituent	*Botanical Origin*
Uva ursi	Bearberry	Arbutin	*Archostaphylo uva ursi*
Poison Ivy Oak	Uroshiol		*Rhus radicans*
			Rhus toxicodendron

▪ LACTONE		CoCaP
	Constituent	Botanical Origin
Coumarin	Warfarin, Dicoumarol, Bishydroxycoumarin,	*Dipterix odorata*
Cantharides	Cantharidin	*Cantharis vesicatoria*
Psoralens	Methoxsalen, Trioxalen	*Ammi majus*

▪ TANNINS					TaNutHam Gapple
Tests	**HYDROLYZABLE**	**NONHYDROLYZABLE**		Constituents	Botanical Origin
	PYROGALLOTANNINS	PHLOBAPHENES, CONDENSED	Hammamelis leaf / Witch Hazel leaf	Hammamelitonin	*Hammamelis Virginia*
Goldbeater's	(+) Blooms Leather	(+) Tanners Red	Nutgall	Tannic acid	*Quercus infectoria*
Ferric Chloride	Blue-black ppt	Green-black ppt		Insect	*Cynips tinctoria*
Bromine Test	(-)	(+)	Japanese & Chinese Galls	Gallic acid	*Rhus chinensis*
$KMnO_4$	Decolorize	Do not decolorize			
	Hydrolysis	Polymerize	Apple		*Pyrus mallus*
	Phenolic acid, sugars, Pyrogallol	Phlobaphenes (red polymers, insoluble)			
True tannins	Can convert to leather	***Christmas-themed non-hydrolyzable tannins***			
Pseudotannins	Can't convert to leather				

LIPIDS

FIXED OILS	FATS	WAXES
Esters of Fatty Acid + Glycerol	Esters of Fatty Acid + Glycerol	Esters of Fatty acid + ↑ MW alcohol
LIQUID except Theobroma oils	SOLID except Cod Liver Oil	Solid, Semisolid, Liquid
Unsaturated FA	Saturated FA	Saturated, Unsaturated FA
Plants	Animals	Plants & Animals
Energy Storage	Energy storage	Protection

FATTY ACIDS

Saturated				Unsaturated	
Caproic	6	Palmitic	16	Palmitic	16
Caprilic	8	Stearic	18	Oleic	18
Capric	10	Arachidic	20	Linoleic	18
Lauric	12	Behemic	22	Linolenic	18
Myristic	14	Lignoceric	24	Arachidonic	20

Reaction of Lipid: Hydrogenation | Sulfation

FATS — TheoLaCoUA

Theobroma	*Theobroma cacao*	Lard	*Sus scrofa*
Anhydrous Lanolin	*Ovis aries*	Butterfat	*Bos Taurus*
Cod Liver oil	*Gadus morrhua*		
Undecylenic acid	*Pyrolysis*	*Ricinus communis*	
Azelaic acid	*Ozonalysis*		
Suet	Beef Tallow	*Bos Taurus*	
	Mutton Tallow	*Ovis aries*	

WAXES — SperJoBeCa

Spermaceti	*Physeter macrocephalus*	Beeswax	*Apis mellifera*
Jojoba oil	*Simmondia chinensis*	Carnauba wax	*Copernicia punifera*

FIXED OILS

Cottonseed oil	Gossypol 0.6%	*Gossypium hirsutum*
Sesame/Teel/Benne oil	Sesamol	*Sesamum indicum*
Coconut oil	Lauric, Myristic	*Cocus nucifera*
Peanut oil		*Arachis hypogaea*
Castor oil	Ricinoleic acid	*Ricinus communis*
Soybean oil	Lecithin	*Glycine soja*
Corn oil	Linoleic, Oleic	*Zea mays*
Safflower oil	Linoleic	*Carthamus tinctorius*
Sunflower oil	Linoleic, Oleic	*Helianthus annuus*
Ethiodized oil		*Papaver somniferum*
Olive oil	Oleic	*Olwa europea*
Almond oil	Oleic	*Prunus amygdalus*
Persic oil	Oleic	Apricot: *Prunus armeniaca*
		Peach: *Prunus persiaca*
Palm Kernel oil	Lauric, Myristic	*Elalis guaneensis*
Linseed/ Flav seed oil	Linoleic	*Linum usitatissimum*
Theobroma oil		*Theobroma cacao*
Hydrogenated Veg. oil	Stearic, Palmitic	

COLOR REACTION

Cotton seed oil	Halphen's test	NagHaCot ng SeBo sa Vegetable si Ser Millon para kay Olive
Sesame oil	Boudoin's test	
Vegetable oil	Serger rxn	
Olive oil	Millon's test	

IODINE VALUE

Non-drying	<100	Olive, Almond	NOA
Semi-drying	100-120	Cottonseed, Sesame	SeCotSe
Drying	>120	Linseed, Cod Liver	LiCod

PHOSPHOLIPIDS			
Lecithin		Cephalin	

VOLATILE OILS		
Lamiaceae	Mint Family	Grandular hair or trichomes
Piperaceae	Pepper family	Modified parenchymal cells
Apiaceae	Dillweed family	Oil tubules or vittae
Pinaceae	Pine Family	Lysigenous & Schizogenous passage
Rutaceae	Citrus Family	

Methods:	
Water distillation	Turpentine
Water & steam Distillation	Clove, Cinnamon
Steam Distillation	Peppermint, Spearmint
Dry distillation	Pinaceae
Destructive	Cupressiaceae
Expression/ Eaile a piquer	Citrus fruits
Enzymatic hydrolysis	Glycosidic VO
	Benzene, Petroleum Ether
Enfleurage	Use of cold fat : ethanol extract
Ecuelle	Rolling fruit
Clavenger apparatus	

TERPENES				
Name	**# C**	**Iso #**	**Example**	
Monoterpene	10	2	Most volatile oils.	
			Limonene	Most common
Sesquiterpene	15	3	Parthenolide	5-HT antagonist
Diterpene	20	4	Paclitaxel	*Taxus brevifolia*
			Forksolin	Zingiberol
Triterpene	30	6	Neem	*Azadirachta indica*
Tetraterpenes	40	8	Retinol	
			Lycopene	

	FIXED OILS	VOLATILE OILS
Composition	Ester of FA + Glycerol	Terpenes, Aromatic cmpds.
Rancidity	✓	×
Resinity	×	✓ = auto-oxidation
Grease spot	+	-
Distilled	×	✓
Saponified	✓	×

COMPONENTS OF VOLATILE OILS			
Stereoptene	*solid* oxidized hydrocarbon portion	Eleoptene	*liquid* hydrocarbon portion
M	Menthol	**M**	Methylsalicylate
A	Anethole	**E**	Eucalyptol
T	Thymol	**E**	Eugenol

2 BROAD CLASSES OF VOLATILE OILS			
1. Terpenoids	Acetate-Mevalonate pathway		
	Monoterpene	Most commonly found VO	
	Sesquiterpene	Largest class of Terpenoids	
2. Aromatic	Shikimic acid pathway	Use: Perfumes	

Top Notes	Most Volatile; leaves the skin readily	**tLAL**	Lemon
			Anise Oil
			Lavender
Middle notes	intermediate	**ThRoNes**	Thyme
			Rose Oil
			Nerole
Base notes	Low, fixative & staying power		
Musk	Male dusk deer of Asia	Muscone	*Muscus spp*
Civet	Discharging pockets of Civet cats	Civetone	*Parodoxus hermaphoditus*
Ambergris	Most valuable base note	Ambrein	

VOLATILE OILS			
▪ HYDROCARBON			HydroTur
Turpentine oil	α & β pinene		*Pinus palustris*
▪ ALCOHOL			CoCaRoNeJuPiPe
Coriander oil	Linalool		*Coriandrum sativum*
Cardamom oil	Cineole		*Eletaria cardamomum*
Rose oil	Geranoil, Nerol, Citronellol		*Rosa gallica*
Neroli oil (Orange Flower oil)	Linalool		*Citrus aurantium*
Juniperus oil	Borneol		*Juniperus communis*
Pine oil			*Pinus palustris*
Peppermint oil	Menthol	American	*Mentha piperita*
	Terpineol	Japanese	*Mentha arvensis*
▪ ALDEHYDE			CitCin Or LeHa
Citronella oil		Citronella, 2-hexanal/ Acetaldehyde	*Cymbopogon winterianus*
			Cymbopogon nardus
			Cymbopogon citrated
Cinnamon oil	Ceylon	Cinnamaldehyde	*Cinnamon zeylanicum*
	Saigon		*Cinnamon laureirii*
	Cassia		*Cinnamon cassia*
Sweet Orange oil		Decanal, Limonene	*Citrus sinensis*
Lemon peel oil		3:1 Geraniol, Neral	*Citrus limon*
Hammamelis oil	Witch Hazel	α-ionone / β-terpinol	*Hammamelis virginia*

▪ PHENOL		Thy in Clove & Creo taste like Juni Myr
Thyme oil	Thymol	*Thymus vulgaris*
Clove oil	Eugenol	*Eugenia caryophillus*
Creosote oil	Creosole, guiacol	*Fagus grandiflorus*
Juniper tar	Cadinene	*Juniperus oxycedrus*
Myricia oil	Eugenol	*Pimenta racemosa*
▪ KETONE		nagCamp sa Car si Buchu with Spear & Cedar may Worm!)
Camphor	Carvone	*Cinnamomum camphora*
Caraway oil	Carvone	*Carum carvi*
Buchu oil	Diosphenol	*Berosma betulina*
Spearmint oil	Carvone	*Mentha spicata*
Cedar leaf oil	Thujone, Fenchone	*Thuja accidentalis*
Wormwood/ Absinthe/ Quinghaosu		*Absinthe absinthum*

▪ PHENOLIC-ETHER			Nut FeAnise
Nutmeg	Myristicin, Safrole		*Myristica fragrans*
Fennel	Trans-anethole, Fenchone		*Foenicilum vulgare*
Anise oil	Trans-anethole, Anisaldehyde		*Pimpinilla anisum*
Star Anise	Chinese	Trans-anethole, Estragole	*Illicium verum*
	Japanese	Hananomin	
▪ OXIDATIVE			OEu
Eucalyptus/Cajuput oil	Cineole		*Eucalyptus globulus*
▪ ESTER			EGa LaPinMu
Gaultheria/ Wintergreen/ Betula/ Sweet Birch oil	Cineole		*Gaultheria procumbens*

Plants parts where volatile oils are obtained			
Cinnamon oil	Dried bark	Oregano	Leaf & Flowering Tops
Clove oil	Flower buds	Cardamon oil	Fruit
Mustard	Seeds	Sandal wood	Heart wood

RESIN

Complex mixture of:

Resin acid	Oxyacid	Esters	Acid + alcohol
Resin alcohols	Resinols	Resenes	Hydrocarbon
Resinotannols	Give color w/ $FeCl_3$		
Resin combination			
Oleoresin	Volatile oil + Resin	Resin acid	Oxyacids (-COOH +phenol)
Oleo-gum-resin	V.O + Gum + Resin	Glycoresin	Resin + CHO

▪ RESIN — **May Kava si Rosin, Jalap (Hanap) ni Santa si Podo Mastic nag Pot**

Kava-kava	Mehysticin, Yangonin, Kawain	*Piper methysticum*
Rosin/ Colophony	Abretic acid, Sylvic acid, Rescene	*Pinus palustris*
Jalap	Jalapin, Purganol	*Exogonium purge*
Yerba Santa/ Eriodyction		*Eriodyctn californium*
Podophyllum	Podophyllin, Peltatin	*Podophyllum peltatum*
Mastic	α-resin, masticin	*Pisracia lentiscus*
Cannabis/ Indian hemp/ Marijuana/ Pot	THC, Cannabidiol, Nabilone	*Cannabis sativa*

▪ OLEORESIN — **TurCapWhite Ginger Bal**

Turpentine		*Pinus Palustris*
Capsicum	Capsaicin	African (Labuyo) *Capsicum frutescens*
		Lousiana long *C.anuum v.longum*
		Irish/ tabasco *C. anuum v.conoides*
White pine		*Pinus strobus*
Ginger	Bisabolene Zingeberol	*Zingiber officinale*
Balsam of Copaiba		*Capaifera spp*

▪ OLEO-GUM-RESIN — **MAgor**

Myrrh		*Commiphora molnol*
Asafetida	Asaresinotannol, ferulic acid	*Ferula foetida*

▪ BALSAM — **STPB**

Storax	Storesin	*Liquidambar orientalis*
Tolu balsam		*Myroxylan balsamum*
Peruvian balsam		*Myroxylan pereirae*
Benzoin		*Styrax benzoin*

BENZOIN TINCTURE "STAB"

Storax	Aloe
Tolu	Benzoin

STEROIDS - Mevalonic acid pathway

Sterol	Cholesterol	Animal
	Ergosterol	Fungi
	Phytosterol	Plants
Bile acid	Primary	Cholic acid, chenodeoxycholic acid
	Secondary	Deoxycholic acid, litocholic acid

Cardiac Glycoside

Hormones	Glucocorticoid	Cortisol	CHO metab
	Mineralocorticoid	Aldosterone	H_2O metab
	Sex Hormones — Male		Androgen, testosterone
	Sex Hormones — Female		Estrogen, Progestin

ALKALOIDS

All alkaloids are **SOLID** EXCEPT:

Conine	Poison hemlock	*Comium maculatum*
Arecoline		
Nicotine	Tobacco leaves	*Nicotania tabacum*
Spartein	Scotch Broom	*Cystisus scoparius*
	Lupin	*Lupinus mutabilis*

ALKALOIDAL REAGENT

Wagner's rgt	Iodine in KI	**WIKI**
Mayer's rgt	K Mercuric Iodide	**MaMeKI**
Valser's rgt	Mercuric Iodide	**VaMI**
Dragendorff's rgt	K Bi Iodide	**DraBiKI**
Bouchard rgt	Iodine in KI	**BIKI**
Marme's rgt	K Cadmium Iodide	**MarCaKI**
Sonnencheim's rgt	Phosphomolybdic	**Syllables**
Scheibler's rgt	Phosphotungstic	
Hager's rgt	Picric acid	
Gold cmpds		
Tannic acid		

▪ PYRIDINE-PIPERIDINE

AA: Ornithine

Nicotiana	Tabacco leaves	Nicotine	*Nicotiana tabaccum*
Areca	Betel Nut	Arecoline, Catechin, Tannin	*Areca catechu*
Lobelia	Indian Tobacco leaves	Lobeline	*Lobelia inflata*
Ipil-ipil			*Leucaena leucocephala*

▪ QUINOLINE

AA: Tryptophan — **CC**

Cinchona	Cinchonine	*Cinchona succirubra*
Thalleioquine:identify quinine	Cinchonidine	*Cinchona calisaya*
Cuprea	Cuprea bark	*Remijia purdiena*

▪ TROPANE

AA: Ornithine — **HyoSCEM BeDuWi**

Hyoscyamus	Henbane	Hyoscyamine	*Hyoscyamus niger*
		Scopolamine	
Stramonium	Dimsonweed	Scopolamine	*Datura stramomium*
	Jamestown weed	Hyoscyamine	
Coca	Huanuco coca		*Erythroxylan coca*
	Truxillo coca		*Erythroxylan truxillense*
	Crack, Coke		
Egyptian Hyocyamus	Egyptian Hyocyamus	Hyoscyamine	*Hyocyamus muticus*
		Scopolamine	
Mandragora	Satan's apple	Mandragorin	*Mandragora officinarum*
Belladona		Atropine	*Atropa belladona*
Duboisa			*Duboisa myoporoides*
Withania			*Withania somnifera*

▪ ISOQUINOLINE

AA: Tyrosine — **ISOT**

Ipecac		Emetine, Psychotrine	Brazillian: *Cephaelis ipecachuanhua*
		Cephaeline	Panama: *C. acuminate*
Sanguinaria	Blood root	Sanguinarine	*Sanguinaria candensis*

Opium	OPIATES		OPIOIDS	
	Morphine	Papaverine	Heroin	Apomorphine
	Codeine	Thebaine		Hydrocodone
	Noscapine			Hydromorphine
Tubocurarine	South America Arrow poison		*Strychnus castelanaei, S. toxifera,*	

▪ IMIDAZOLE		AA: Histidine	**Pimidazole**
Pilocarpine		*Pilocarpus jaborandi*	
▪ STEROIDAL		CPPP nucleus	**Stebore**
Green Hellebore	American	Germidine Germetrine	*Veratrum viride*
White Hellebore	European	Protoveratine A & B	*Varatrum album*
▪ ALKALOIDAL AMINE		AA: Phenylethylamine, Tryptophan	**PPECK**
Peyote	Mescal buttons	Mescaline	*Lophophora williamsii*
Psilocybe		Psilocybin	*Psilocybe mexicana*
Ephedrine	Ma Huang	Ephedrine	*Ephedra sinica*
Colchicum	Colchicine		*Colchicum automnale*
Khat	Abysinian Tea	Cathenone	*Catha edulis*
▪ INDOLE		AA: L-tryptophan	**VEsPReN**
Vinca alkaloids	Madagascar periwinkle, Chichira	Vinblastine, Vincristine	*Catharantus roseous*
Ergonovine		Ergot	Parasitic: *Claviceps purpurea* Saphrotic: *C.paspanii*
Physostigmine		Calabar, Ordeal	*Physostigma venenosum*
Reserpine	Snakeroot	Rauwolfia	*Rauwolfia serpentina*
Nux Vomica		Strychnine	*Strychnus ignatii*
▪ PURINE		AA: Glycine, Glutamine, aspartic acid	
Coffee		Caffeine	*Coffea arabica, C.robusta, C.liberica*
Theophylline	Tea	Aminophylline	*Cammela sinensis*
Theobromine			*Theobroma cacao*
Cola	Kola nuts	Kola catechin	*Cola nitida*
Guarana		Caffeine, Cathecolamine	*Paulliana cupana*

ENZYMES			
Coenzyme	Enzyme + vitamins (organic & inorganic substances) *cofactor = non enzyme part of enzyme		
Zymogen or Proenzyme	Inactive factor	Apoenzyme	Protein part of enzyme
CARBOHYDRATE			
Amylase + Diastase	Salivary gland	Zymase	
Amylosin		Emulsin	Amygdalase + Prunase
Ivertase		Myrosin	
ESTERASE			
Lipase		Urase	
PROTEOLYTIC ENZYMES			
Pepsin	Convert proteins to protease & peptones		
Trypsin	Converts protease & peptones to polypeptides and amino acids		Rennin
SOURCES OF ENZYME			
Pepsin	*Sus scrofa* *proteolytic enzyme		
Pancreatin	Sus scrofa or Bos Taurus *amylase, lipase & protease		
Bromolains	*Anonas comosus* *mixture of protein digesting & milk clotting		
Streptokinase	Purified bacterial protein elaborated by Group C β-hemolytic streprococci		
Papain	*Carica papaya*	Collagenase	*Clostridium histolyticum*
Urokinase	From urine or kidney cells	L-asparaginase	*E.Coli*
Sustilains	*Bacillus subtilis* *proteolytic enzyme		

VITAMINS

▪ FAT SOLUBLE — ADEK

Vit.A	Retinol	Tretinoin, Isotretinoin			
Vit.D	Sunshine Vitamin	**D_3** Cholecalciferol-7-dehydrocholesterol			
		D_2 Ergocalciferol, Ergosterol			
Vit.E	α-tocopherol				
Vit.K	Vit.K_1	Phytomenadione	Vit.K_3	Menadione	
	Vit.K_2	Phenylmenaquinone	Vit.K_4	Menadiol	

▪ WATER SOLUBLE — TaRaNaPaPy BFCo

1. Vitamin B Complex

B_1	Thiamine	B_5	Pantothenic acid	B_9	Folic acid
B_2	Riboflavin	B_6	Pyridoxine	B_{12}	Cobalamin
B_3	Niacin	B_7	Biotin		

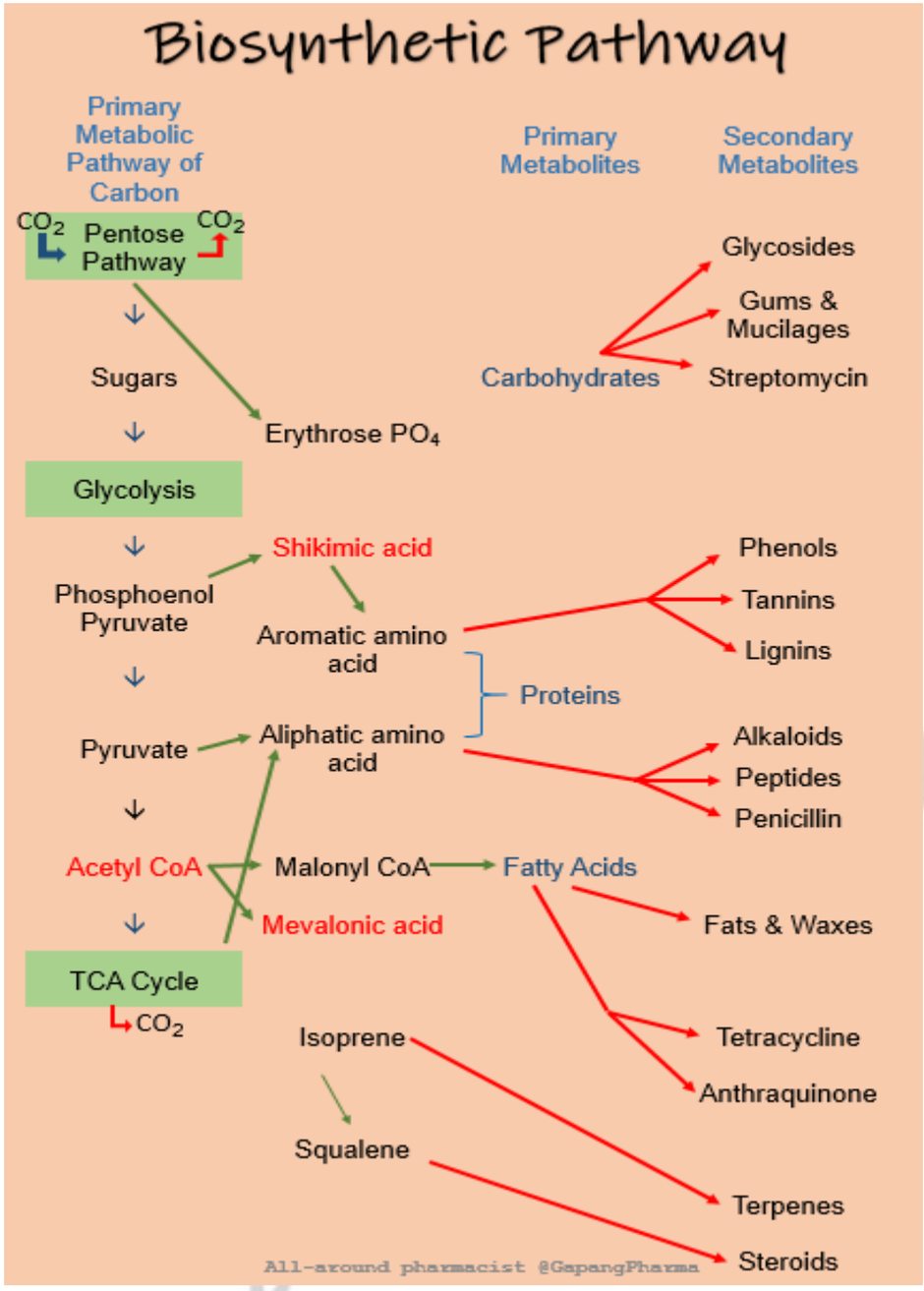
2. Yeast	Sugar = Alcohol + CO_2	Brewer's yeast	*Saccharamyces cerevisiae*
		Tarula yeast	*Candida utilis*
3. Vit.C	Ascorbic acid		
4. Vit. H	Biotin		

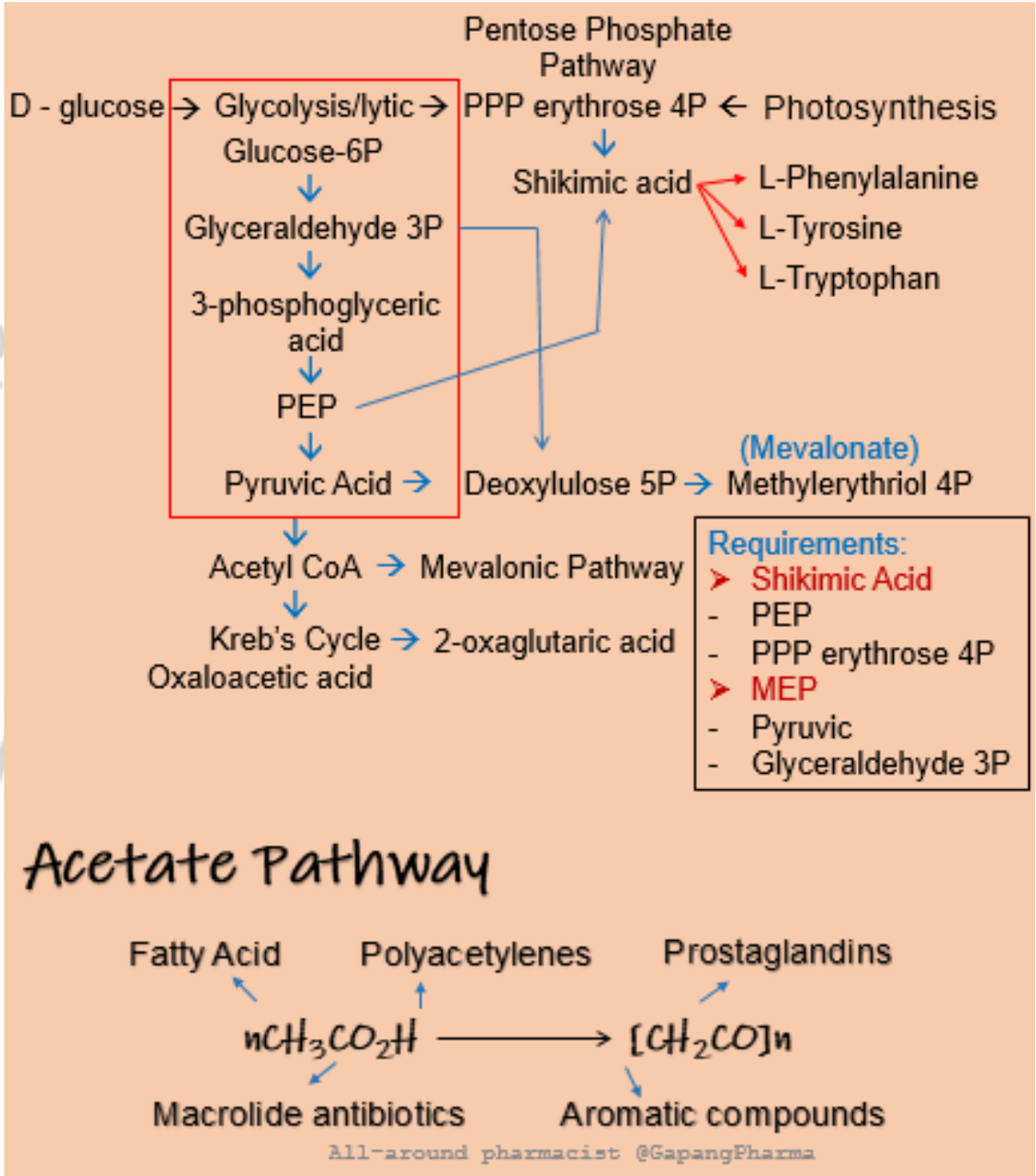
10 HALAMANG GAMOT — BABY PLANTS

Common	Scientific	Family	Use
Bawang	*Allium sativum*	Lilaceae	Anti-HTN
Akapulko	*Cassia alata*	Fabaceae	Anti-Fungal
Bayabas	*Psidium guajava*	Myrtaceae	Antiseptic
Yerba Buena	*Mentha cordifolia* *Clinopodium douglasi*	Lamiaceae	Analgesic
Pansit-pansitan	*Peperomia pellucida*	Piperaceae	↓ Uric acid
Lagundi	*Vitex negundo*	Lamiaceae	Cough prep.
Ampalaya	*Momordica charantia*	Cucurbitaceae	Anti-DM
Niyog-niyogan	*Combretum indicum* *Quiqualis indica*	Combretaceae	Anthelmintic
Tsaang-gubat	*Carmona retusa* *Erretia microphylla*	Boraginaceae	Antidiarrheal
Sambong	*Blumea balsimifera*	Asteraceae	Diuretic

VITAMIN		FUNCTION	DISEASE
B_1	Thiamine	Aldehyde transfer	Beri-beri, Wernicke-Korsakoff
B_2	Riboflavin	REDOX (FAD, FMN)	Cheliosis, Angular stomatitis
B_3	Niacin	REDOX (NAD,NADP)	**Pellagra 3D** Dermatitis, Diarrhea, Dementia
B_5	Panthothenic Acid	CoA Transamination	Burning Foot Syndrome Peripheral Neuropathy
B_6	Pyridoxine	Carboxylation	
B_7	Biotin	Transfer of 1C component	
B_9	Folic Acid	Transfer of 1C component	
B_{12}	Cyanocobalamin		

VITAMIN	FUNCTION	DISEASE
C	Collagen synthesis	
K	Clotting Factors δ-carboxylation of Glu residues in CF	
A		Nyctalopia (night blindness) Xeropthalmia (dry eyes)
D		Ricketts (kids) Osteomalacia (adults)


Biosynthetic Pathway
Primary Metabolic Pathway of Carbon
Primary Metabolites
Secondary Metabolites
CO2
Pentose Pathway
CO2
Sugars
Erythrose PO4
Glycolysis
Phosphoenol Pyruvate
Shikimic acid
Aromatic amino acid
Proteins
Pyruvate
Aliphatic amino acid
Acetyl CoA
Malonyl CoA
Fatty Acids
Mevalonic acid
TCA Cycle
CO2
Carbohydrates
Glycosides
Gums & Mucilages
Streptomycin
Phenols
Tannins
Lignins
Alkaloids
Peptides
Penicillin
Fats & Waxes
Tetracycline
Anthraquinone
Isoprene
Squalene
Terpenes
Steroids
All-around pharmacist @GapangPharma


Pentose Phosphate Pathway
D - glucose
Glycolysis/lytic
PPP erythrose 4P
Photosynthesis
Glucose-6P
Shikimic acid
L-Phenylalanine
L-Tyrosine
L-Tryptophan
Glyceraldehyde 3P
3-phosphoglyceric acid
PEP
Pyruvic Acid
Deoxylulose 5P
(Mevalonate)
Methylerythriol 4P
Acetyl CoA
Mevalonic Pathway
Kreb's Cycle
2-oxaglutaric acid
Oxaloacetic acid
Requirements:
Shikimic Acid
PEP
PPP erythrose 4P
MEP
Pyruvic
Glyceraldehyde 3P
Acetate Pathway
Fatty Acid
Polyacetylenes
Prostaglandins
nCH3CO2H
[CH2CO]n
Macrolide antibiotics
Aromatic compounds
All-around pharmacist @GapangPharma