MedUPTICK
KNOWLEDGE
CLINICAL
INSIGHTS, &
TEST
PRACTICE,
USMLE

MEDUPTICK.COM

25 Biochemistry Fast Facts to Smash Step 1

1st Edition

(Memorize Smarter, Score Higher.)

Essential high-yield facts Step 1 students can't afford to miss.

Helping Elevate Your Clinical Mastery

📌 Copyright Notice

📌 Usage Policy

This resource is intended for personal use only. If you wish to share this content with others, please direct them to MedUPTICK.com for official access.

📌 Report Unauthorized Use

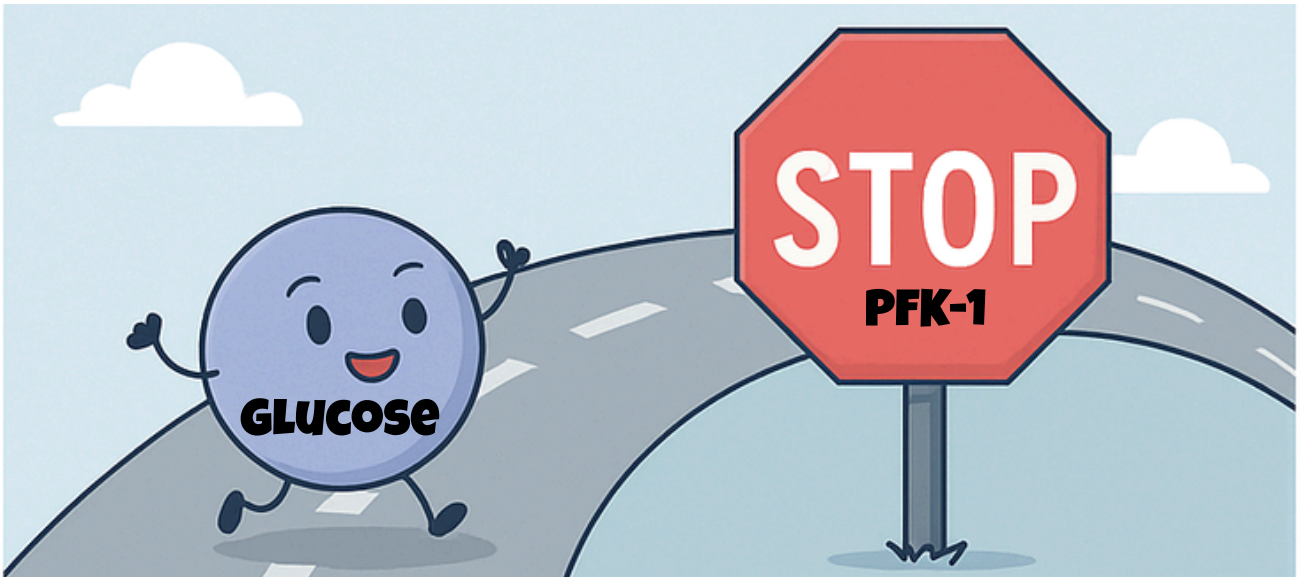
If you come across unauthorized sharing of this document, please contact us at info@meduptick.com.

Table of Contents

Fast Fact # 1:

Rate-Limiting Step of Glycolysis

The step you MUST know cold for Step 1.



Phosphofructokinase-1 (PFK-1) is the rate-limiting enzyme in glycolysis.

Why it Matters:

- PFK-1 controls the pace of glycolysis — no PFK-1 = no go.
- Highly regulated by ATP (inhibits) and AMP (activates).
- Major USMLE favorite: expect questions involving low energy states (AMP upregulates).

Pro Tip:

If a question mentions energy control and glycolysis, think: PFK-1 is the boss!

Quick Memory Hook:

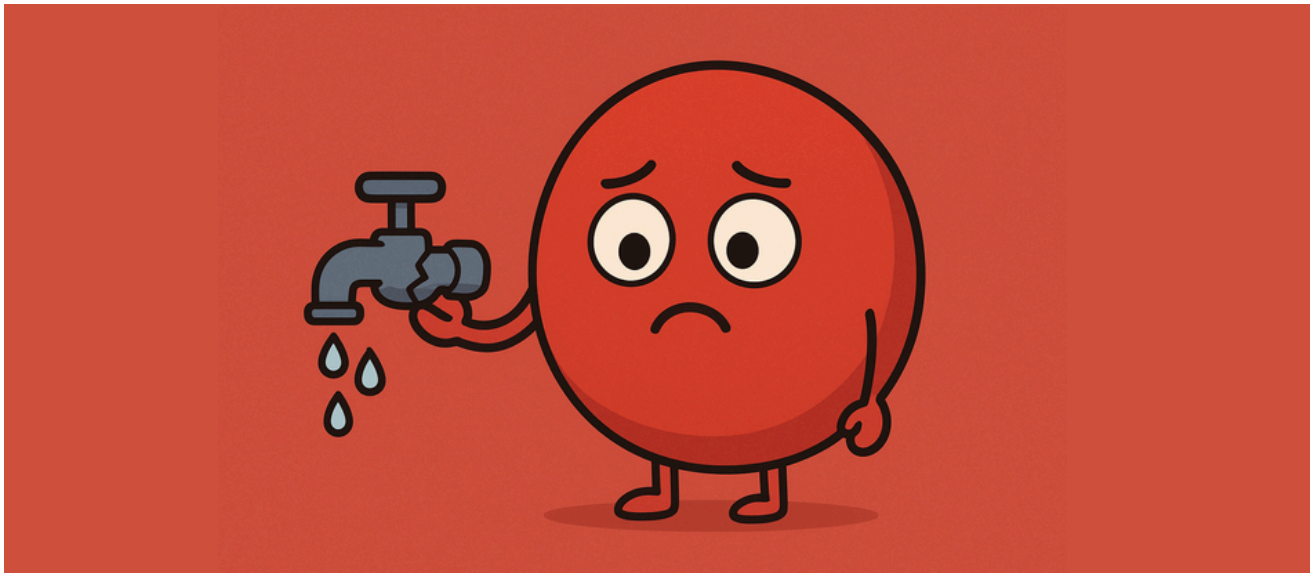
Glucose can sprint... but PFK-1 decides when to hit the brakes.

TABLE OF CONTENTS

Fast Fact #2:

Pyruvate Kinase Deficiency

The key cause of hemolytic anemia is tied to energy failure.



Pyruvate kinase deficiency leads to hemolytic anemia.

Why it Matters:

- Without pyruvate kinase, RBCs can't maintain Na+/K+ pumps, leading to hemolysis.
- No ATP → cell death.

Pro Tip:

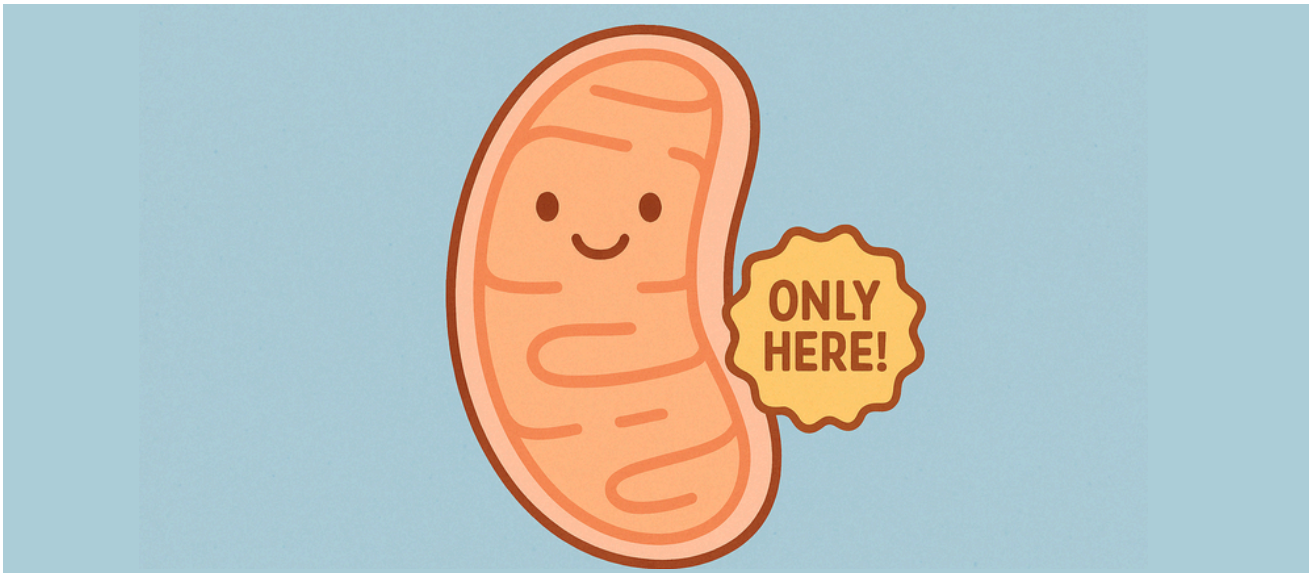
Look for signs of newborn jaundice, anemia, and reticulocytosis.

Quick Memory Hook:

RBCs without fuel = pop and drop.

Fast Fact #3:
Only Gluconeogenesis Enzyme in Mitochondria

Know where pyruvate carboxylase lives — Step 1 loves this.



Pyruvate carboxylase is the only gluconeogenesis enzyme in mitochondria.

Why it Matters:

- Converts pyruvate to oxaloacetate inside mitochondria.
- First step in gluconeogenesis.

Pro Tip:

Always connect pyruvate carboxylase to mitochondria — easy points!

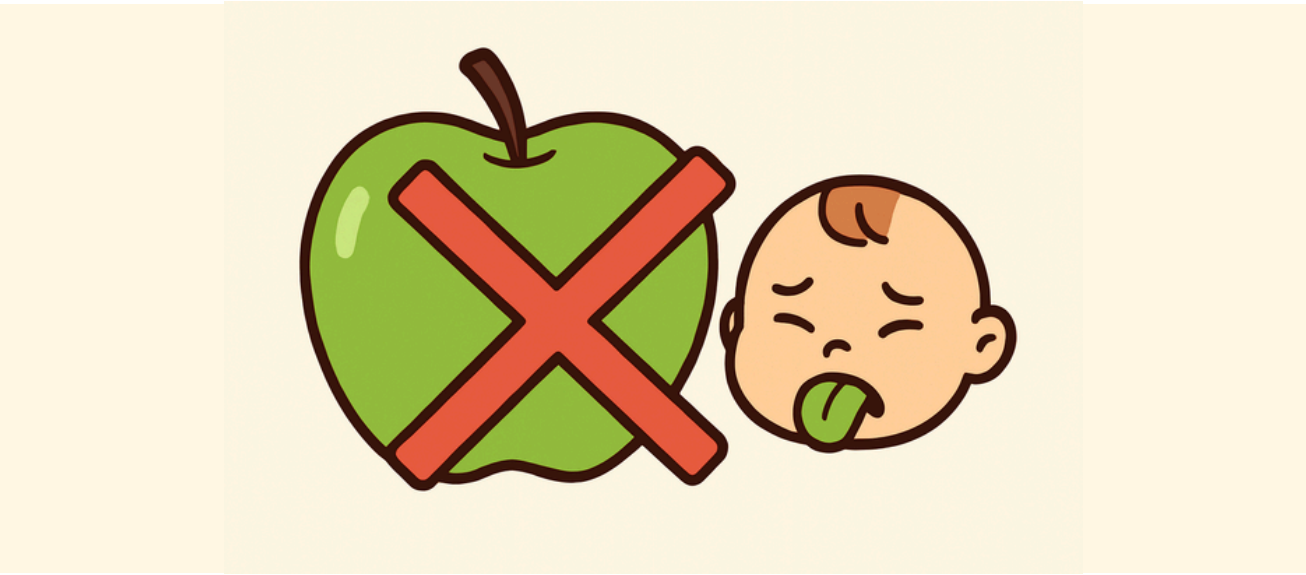
Quick Memory Hook:

Mitochondria: the official headquarters of pyruvate carboxylase.

Fast Fact #4:

Hereditary Fructose Intolerance

Common cause of hypoglycemia and vomiting in infants.



Aldolase B deficiency leads to hereditary fructose intolerance.

Why it Matters:

- Fructose-1-phosphate builds up → hypoglycemia.
- Symptoms after eating fruits or juices.

Pro Tip:

Any vomiting after fruits? Think fructose metabolism issues first.

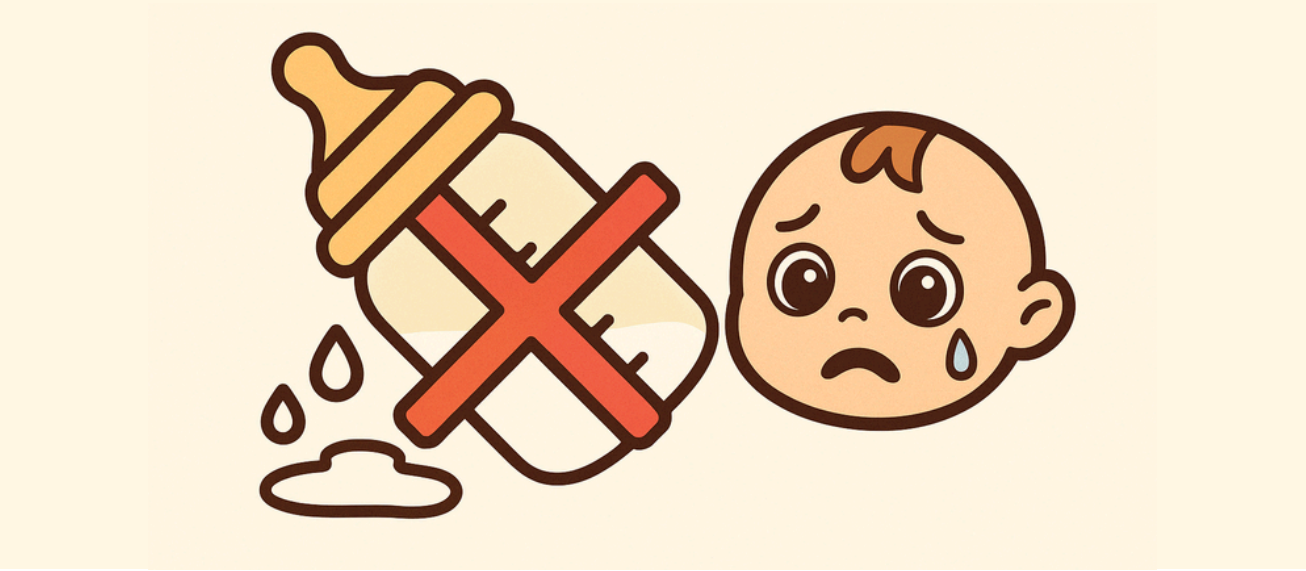
Quick Memory Hook:

Fruit makes baby puke? Blame Aldolase B.

Fast Fact #5:

Classic Galactosemia

Recognize galactosemia signs early — high-yield diagnosis



GALT deficiency causes classic galactosemia.

Why it Matters:

- Early milk ingestion → vomiting, cataracts, hepatomegaly.
- Fatal if untreated.

Pro Tip:

Check for cataracts and liver dysfunction after feeding in neonates.

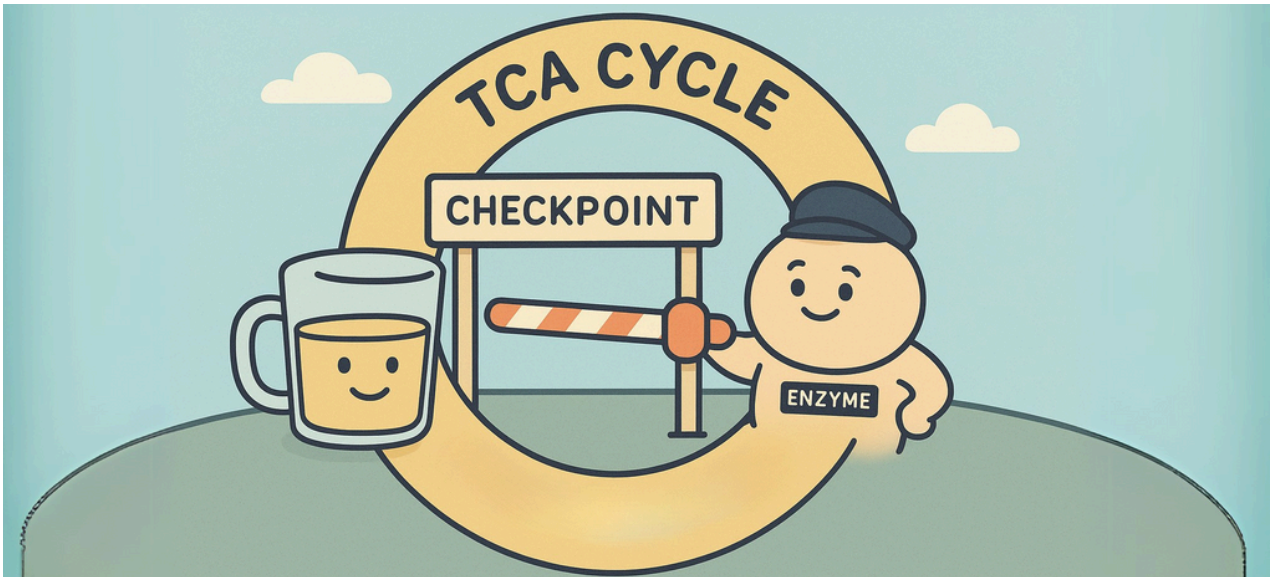
Quick Memory Hook:

Galactose turns milk sweet... and dangerous without GALT.

Fast Fact #6:

Rate-Limiting Step of TCA Cycle

Know the control point for cellular respiration.



Isocitrate dehydrogenase is the rate-limiting enzyme of the TCA cycle.

Why it Matters:

- Regulates pace of TCA cycle energy production.
- Activated by ADP, inhibited by ATP and NADH.

Pro Tip:

If ATP is high, TCA slows; if ADP is high, TCA races!

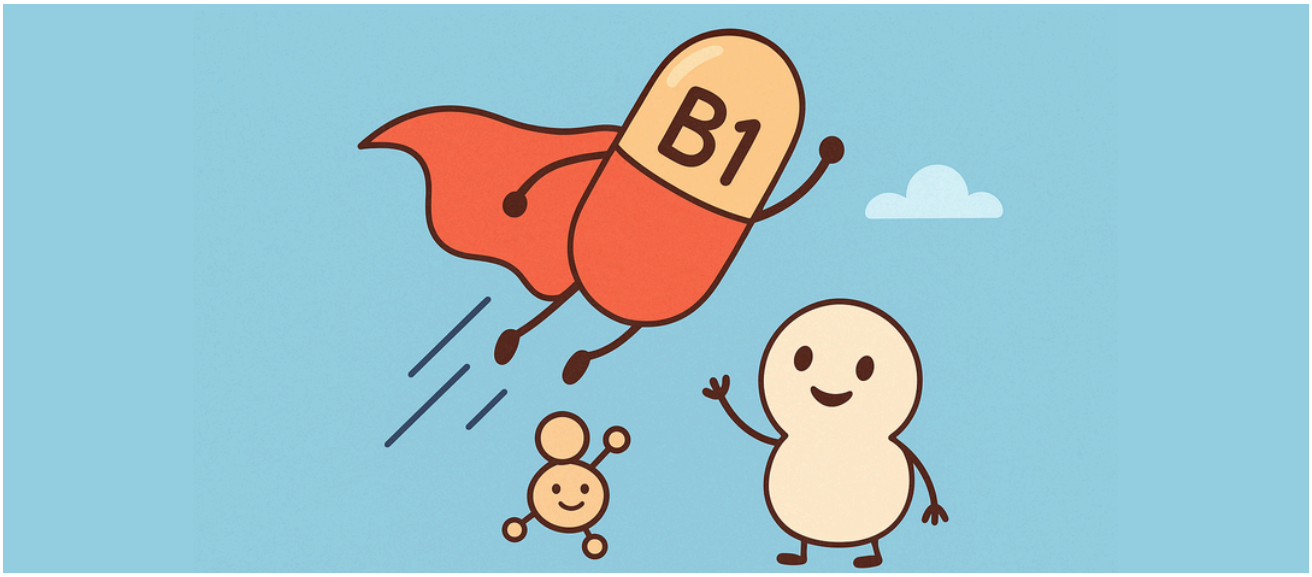
Quick Memory Hook:

Isocitrate = checkpoint traffic cop of the TCA!

Fast Fact #7:

Pathway Requiring Thiamine (Vitamin B1)

Memorize the B1 pathways! Step 1 high-yield.



Thiamine (Vitamin B1) is required for the pyruvate dehydrogenase complex.

Why it Matters:

- Needed for decarboxylation reactions.
- Deficiency leads to lactic acidosis.

Pro Tip:

Always associate B1 with pyruvate dehydrogenase and α-ketoglutarate dehydrogenase.

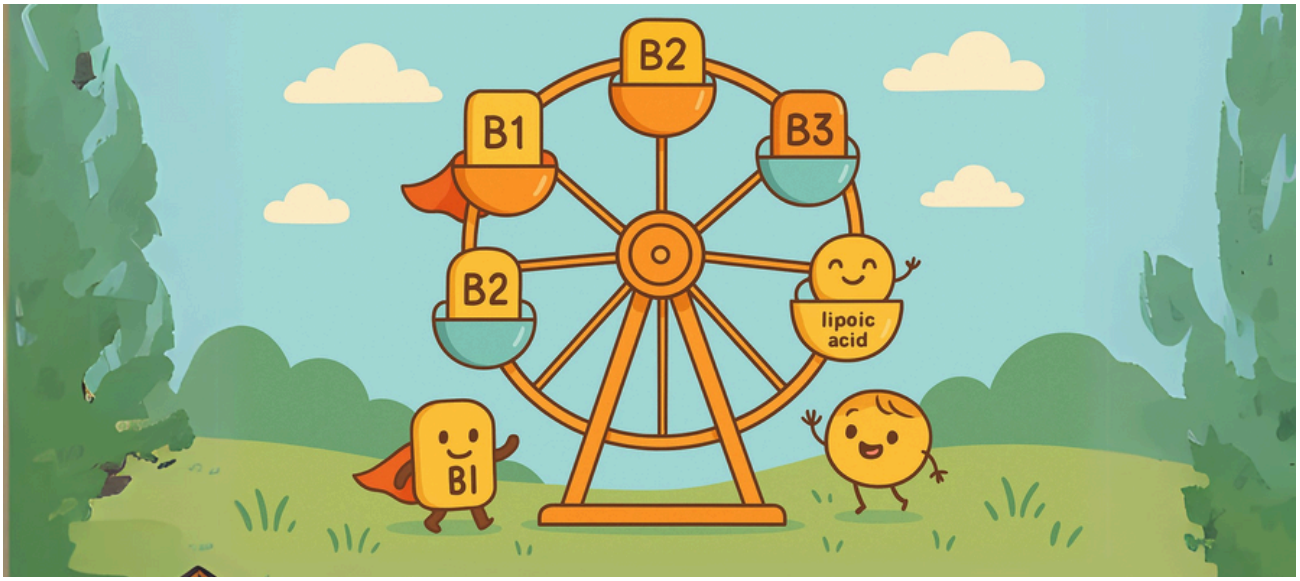
Quick Memory Hook:

B1: The cape-wearing superhero of metabolism.

Fast Fact #8:

Cofactors for α-Ketoglutarate Dehydrogenase

TCA cycle essentials you need to know cold.



α-Ketoglutarate dehydrogenase requires B1, B2, B3, B5, and lipoic acid.

Why it Matters:

- Major Step 1 trap: missing any one cofactor derails TCA cycle.
- Especially important in thiamine deficiency (Wernicke-Korsakoff).

Pro Tip:

Remember: Cofactors spin the TCA wheel smoothly!

Quick Memory Hook:

No passengers, no spin — cofactors make TCA turn.

Fast Fact #9:

Main Enzyme Deficiency in PKU

The classic inborn error — Step 1 favorite.

Phenylalanine hydroxylase deficiency causes classic PKU.

Why it Matters:

- Accumulation of phenylalanine leads to this high-yield triad: **intellectual disability, musty odor, and eczema.**
- Treatment: low-phenylalanine diet.

Pro Tip:

Musty odor + developmental delay? Always think PKU!

Quick Memory Hook:

Broken phenylalanine bridge leads to brain fog.

Fast Fact #10:

Enzyme Deficiency in Tay-Sachs Disease

Classic presentation: cherry-red macula with progressive neurodegeneration and ***no*** hepatosplenomegaly

Hexosaminidase A deficiency causes Tay-Sachs disease.

Why it Matters:

- Accumulation of GM2 ganglioside.
- Neurodegeneration, developmental delay, exaggerated startle reflex.

Pro Tip:

Cherry-red macula + no hepatosplenomegaly = Tay-Sachs!

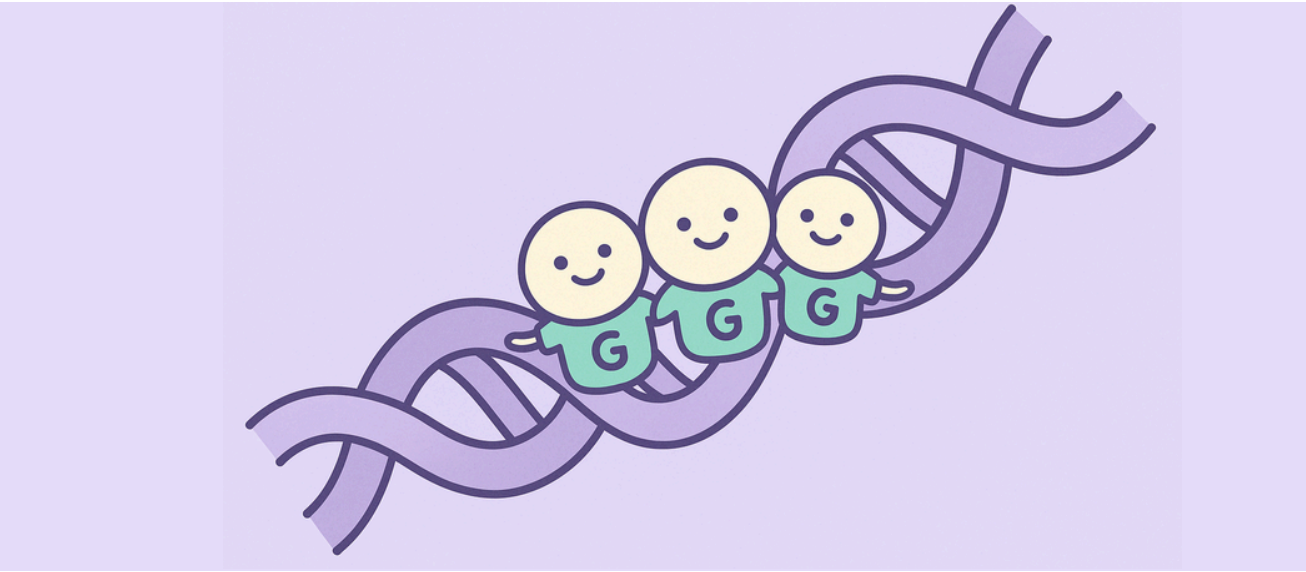
Quick Memory Hook:

Tay-Sachs stacks GM2 until neurons collapse.

Fast Fact #11:

Key Amino Acid for Collagen Synthesis

Know your collagen components — easy Step 1 points.



Glycine is the most abundant amino acid in collagen.

Why it Matters:

- Essential for collagen's tight triple helix formation.
- Deficiency affects structural stability (e.g., scurvy, Ehlers-Danlos).

Pro Tip:

Glycine makes collagen twist tight and strong!

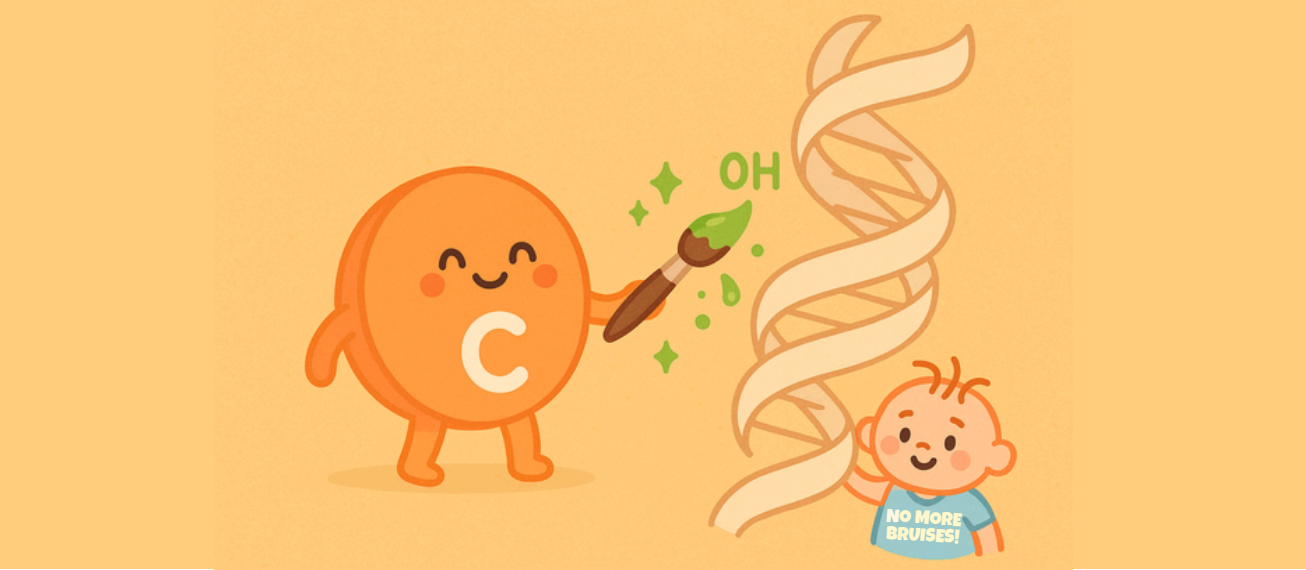
Quick Memory Hook:

Without glycine, collagen unravels like cheap yarn.

Fast Fact #12:

Vitamin C Role in Collagen Synthesis

Vitamin C = strong connective tissues.



Vitamin C is required for hydroxylation of proline and lysine residues in collagen.

Why it Matters:

- Hydroxylation stabilizes collagen fibers.
- Deficiency = Scurvy (easy bruising, gum bleeding).

Pro Tip:

Vitamin C paints strength onto collagen!

Quick Memory Hook:

No C, no sturdy sea ropes (collagen collapses).

Fast Fact #13:

Enzyme Deficient in Alkaptonuria

Easy black-pigment clue on Step 1.

Alkaptonuria is caused by homogentisate 1,2-dioxygenase deficiency.

Why it Matters:

- Black pigment deposits in connective tissues (ochronosis).
- Urine darkens on standing.

Pro Tip:

Black urine + joint pain in an adult = Alkaptonuria!

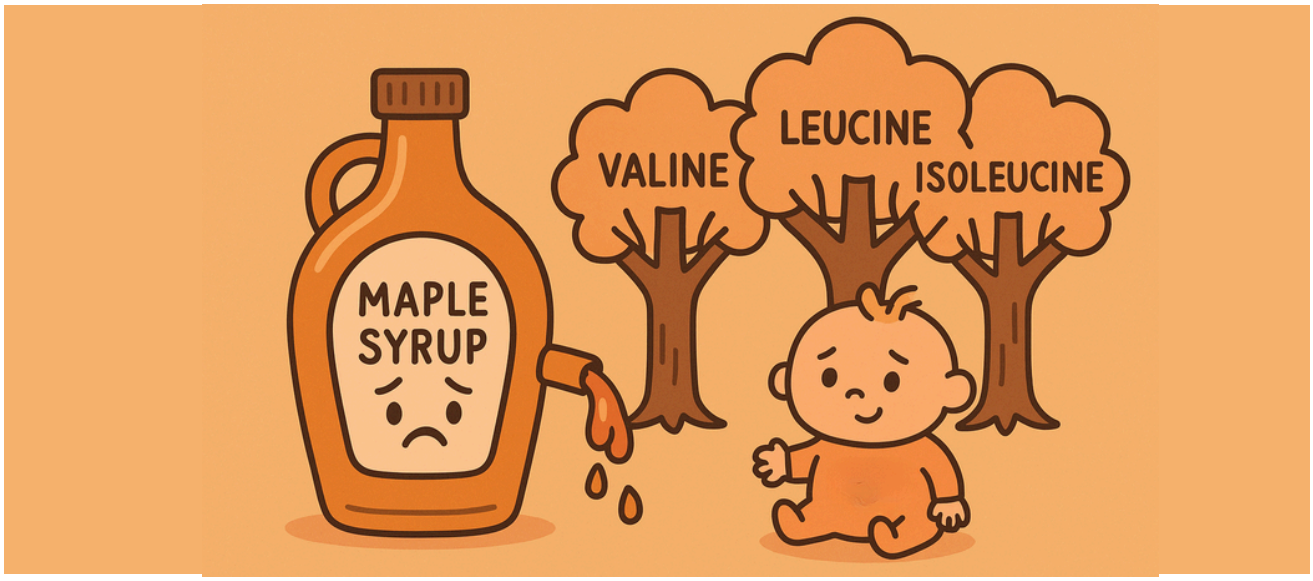
Quick Memory Hook:

Spill black ink? Think Alkaptonuria sink!

Fast Fact #14:

Maple Syrup Urine Disease (MSUD)

Think syrupy mess in branched chains.



Branched-chain α-ketoacid dehydrogenase deficiency causes MSUD.

Why it Matters:

- Accumulation of branched-chain amino acids.
- Sweet-smelling urine, lethargy, poor feeding.

Pro Tip:

Sweet-smelling baby? Suspect MSUD immediately!

Quick Memory Hook:

Maple syrup flows until enzymes clog the branching trees!

Fast Fact #15:

Homocystinuria

The marfanoid mimic with a deadly twist.

Cystathionine β-synthase deficiency causes homocystinuria.

Why it Matters:

- Marfanoid habitus, lens subluxation (downward), thrombotic events.
- High risk for vascular accidents.

Pro Tip:

Tall, thin, dislocated lens? Always screen for thrombosis = Homocystinuria.

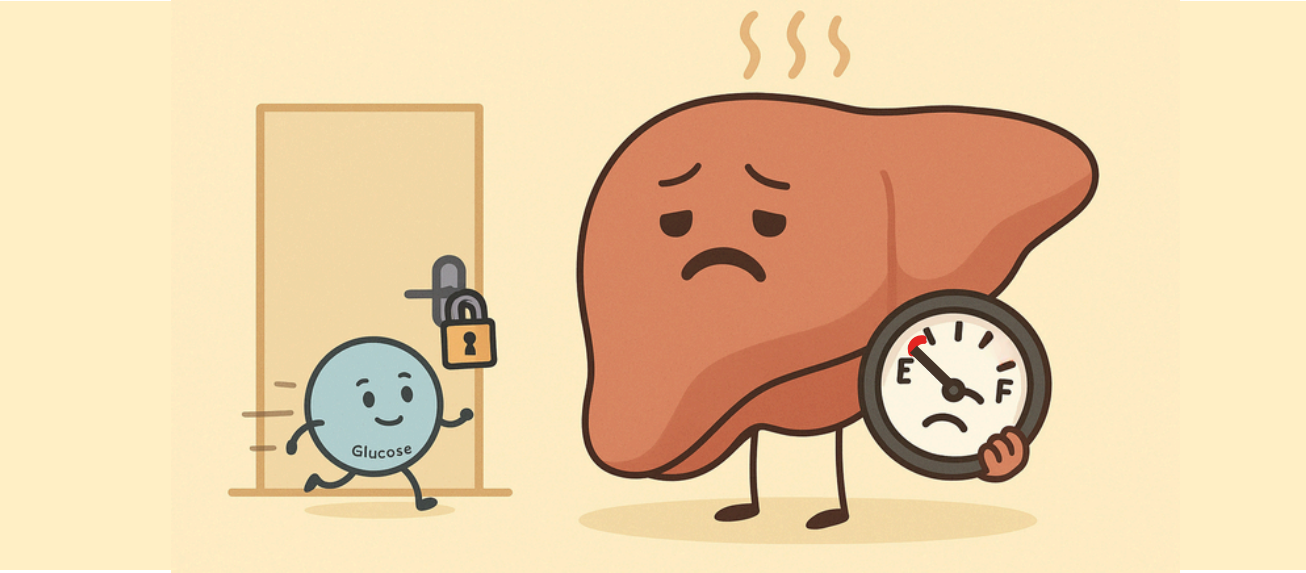
Quick Memory Hook:

Broken sulfur bridge = clot bridge collapse!

Fast Fact #16:

Von Gierke Disease (Type I Glycogen Storage)

Glycogen stuck = major hypoglycemia.



Glucose-6-phosphatase deficiency causes Von Gierke disease.

Why it Matters:

- Severe fasting hypoglycemia, hepatomegaly, lactic acidosis.
- Can't release free glucose into bloodstream.

Pro Tip:

If you see fasting hypoglycemia + big liver, think Von Gierke!

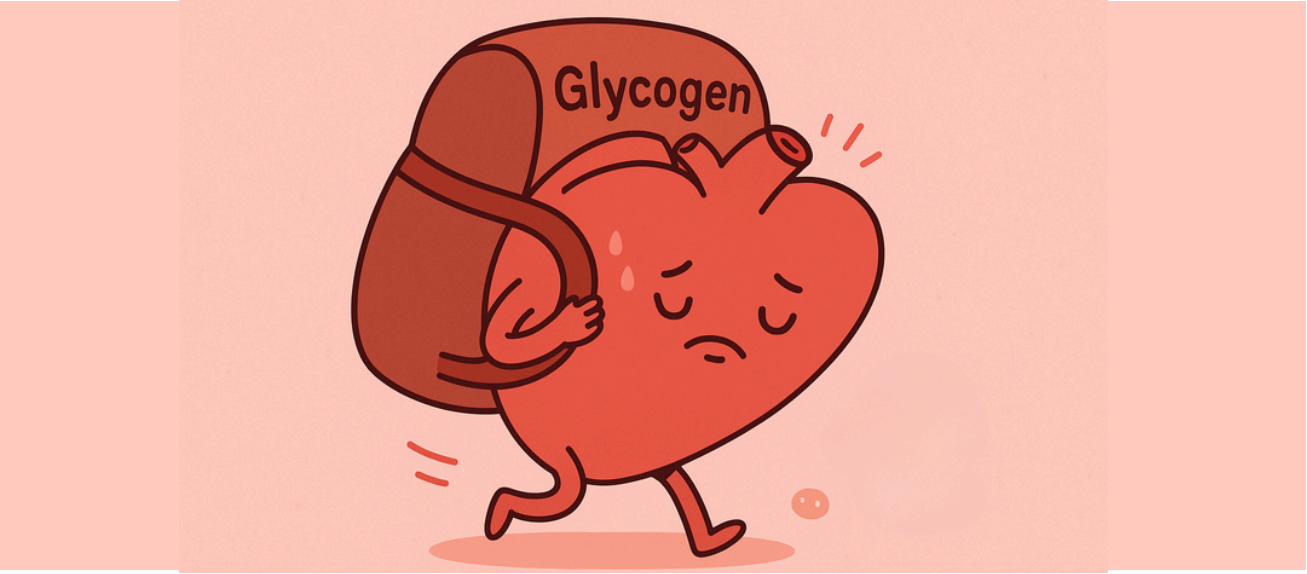
Quick Memory Hook:

Liver has glucose... but no exit door without glucose-6-phosphatase.

Fast Fact #17:

Pompe Disease
(Type II Glycogen Storage)

Big heart failure in infants = major clue.



Lysosomal α-1,4-glucosidase deficiency causes Pompe disease.

Why it Matters:

- Cardiomegaly, hypotonia, early death.
- Glycogen accumulates in lysosomes.

Pro Tip:

Pompe pumps the heart — when it fails, the heart fails too.

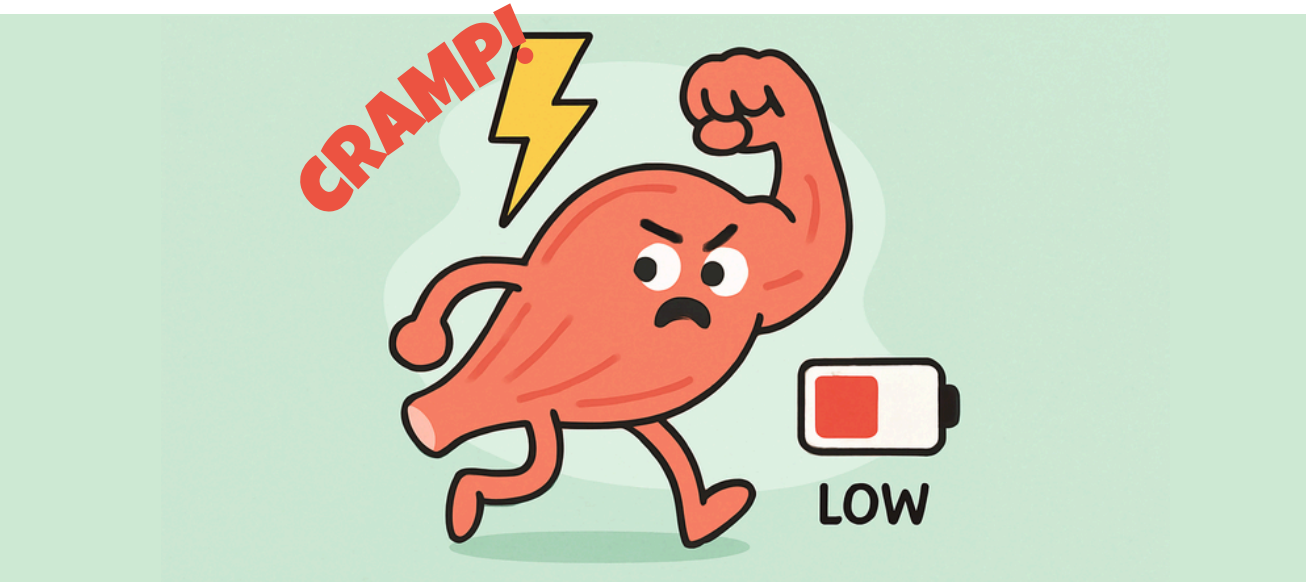
Quick Memory Hook:

Pompe packs glycogen until the heart collapses.

Fast Fact #18:

McArdle Disease (Type V Glycogen Storage)

Muscle cramps = glycogen breakdown failure.



Muscle phosphorylase deficiency causes McArdle disease.

Why it Matters:

- Painful muscle cramps, myoglobinuria after exercise.
- Blood glucose levels typically normal.

Pro Tip:

If cramps + dark urine after exercise = suspect McArdle!

Quick Memory Hook:

Muscles try to run... but crash without energy fuel.

Fast Fact #19:

Most Abundant Amino Acid in Blood

Most Abundant Amino Acid in Blood

Glutamine is the most abundant amino acid in the blood.

Why it Matters:

- Important nitrogen carrier, buffer in acid-base balance.
- Critical for rapidly dividing cells.

Pro Tip:

Think of glutamine as the river taxi for nitrogen transport!

Quick Memory Hook:

Glutamine keeps the bloodstream flowing strong.

Fast Fact #20:

Enzyme Deficient in Lesch-Nyhan Syndrome

Purine salvage system meltdown = an exam favorite.

Lesch-Nyhan syndrome is caused by hypoxanthine-guanine phosphoribosyltransferase (HGPRT) deficiency.

Why it Matters:

- Hyperuricemia, self-mutilation, gout, intellectual disability.
- X-linked recessive inheritance.

Pro Tip:

If you see self-mutilation + gouty symptoms in a boy = Lesch-Nyhan!

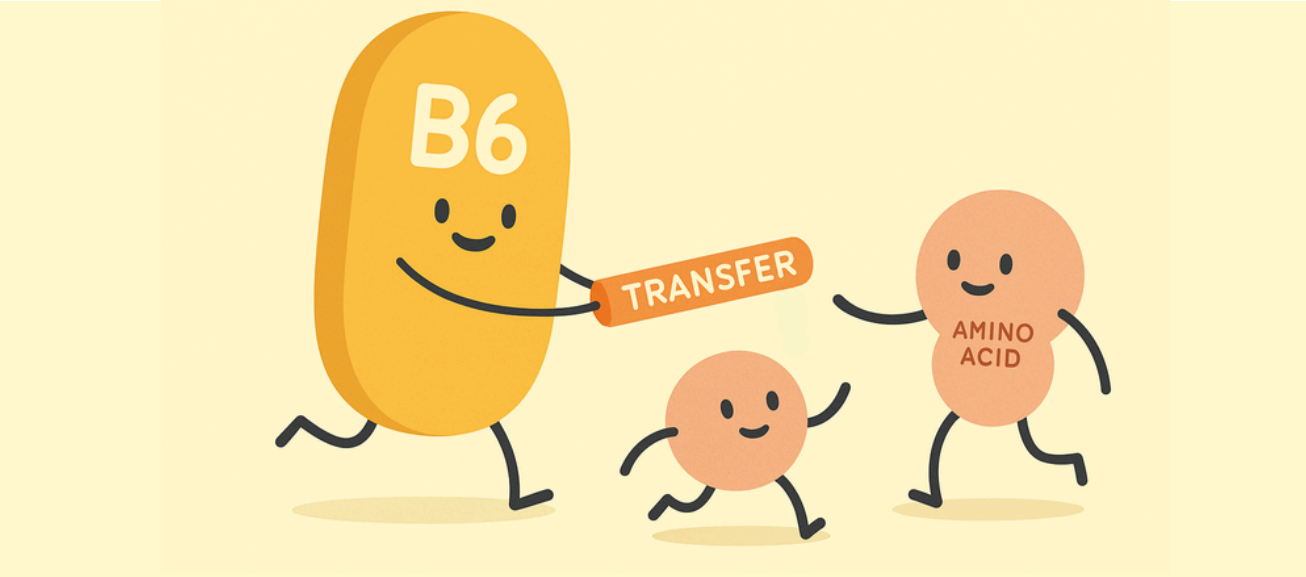
Quick Memory Hook:

INo HGPRT = Purine castle collapse and chaos!

Fast Fact #21:

Vitamin Needed for Transamination Reactions

B6 = MVP of amino group transfers.



Pyridoxine (Vitamin B6) is needed for transamination reactions.

Why it Matters:

- Transfers amino groups between molecules.
- Required for amino acid metabolism.

Pro Tip:

No B6 = no handoff = no amino metabolism!

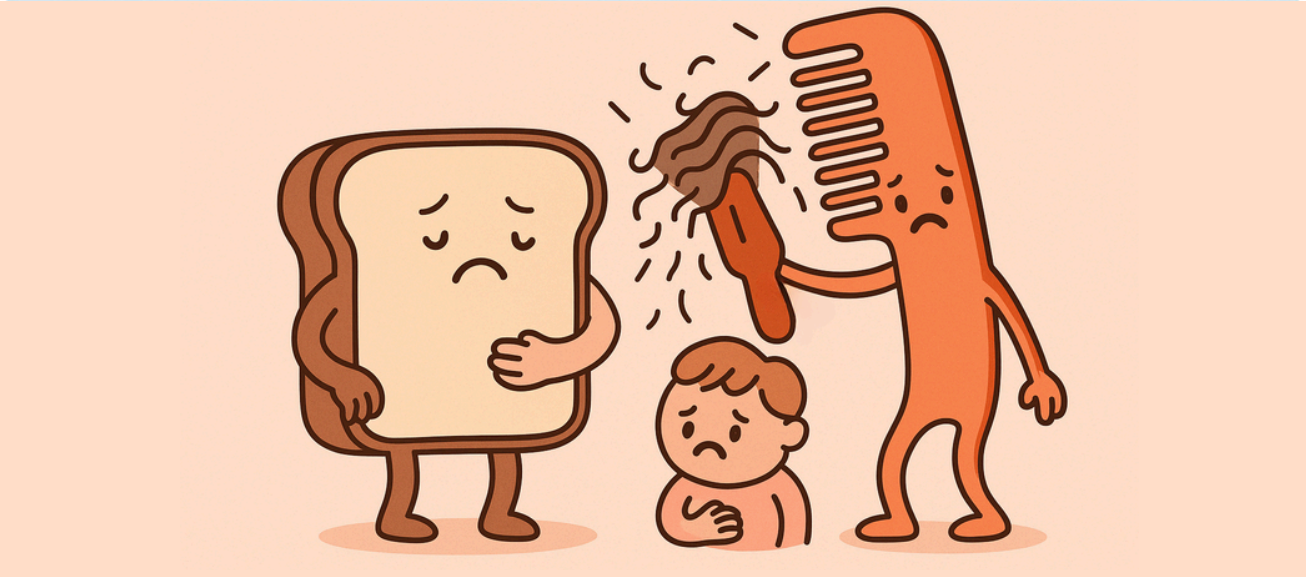
Quick Memory Hook:

B6 passes the amino baton to keep metabolism racing.

Fast Fact 22:

Classic Finding in Biotin (Vitamin B7) Deficiency

Watch for hair loss clues — easy Step 1 point.



Biotin deficiency causes dermatitis, alopecia, and enteritis.

Why it Matters:

- Seen with raw egg white ingestion (avidin binds biotin).
- Also caused by long-term antibiotic use.

Pro Tip:

If hair falls out + stomach aches = suspect biotin deficiency!

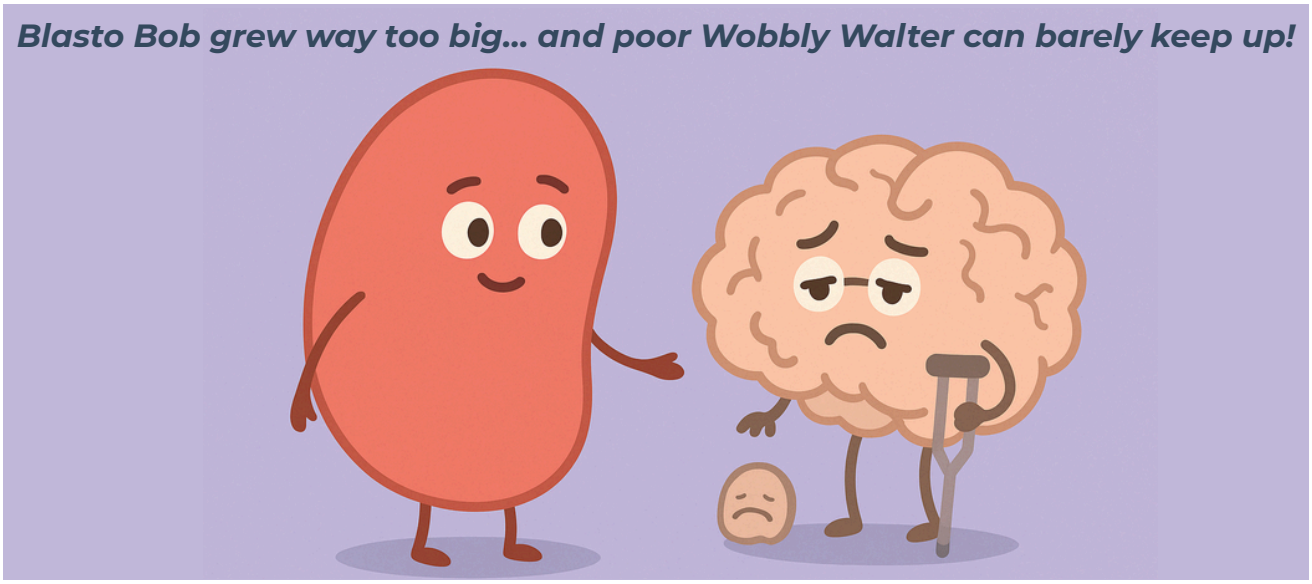
Quick Memory Hook:

No B7 = hair falls, gut stalls.

Fast Fact #23:

Vitamin Causing Megaloblastic Anemia and Neuro Symptoms

B12: Big cells + brain fog.



Vitamin B12 deficiency causes megaloblastic anemia and neurologic symptoms (e.g., paresthesia, ataxia), whereas folate deficiency causes only megaloblastic anemia without neurologic symptoms.

Why it Matters:

- Impaired DNA synthesis → big RBCs.
- Demyelination → neuro deficits (paresthesia, ataxia).

Pro Tip:

If anemia + weird neuro signs = B12 deficiency over folate!

Quick Memory Hook:

Big cells, foggy brain? Blame B12 drain.

Fast Fact #24:

Primary Carrier of Cholesterol in Blood

LDL = delivery truck of doom.

LDL transports cholesterol to peripheral tissues; oxidized LDL is taken up by macrophages, leading to foam cell formation and atherosclerotic plaque development.

Why it Matters:

- High LDL = risk factor for atherosclerosis.
- Target of statin therapy.

Pro Tip:

LDL drops off cholesterol wherever it pleases — and wrecks arteries.

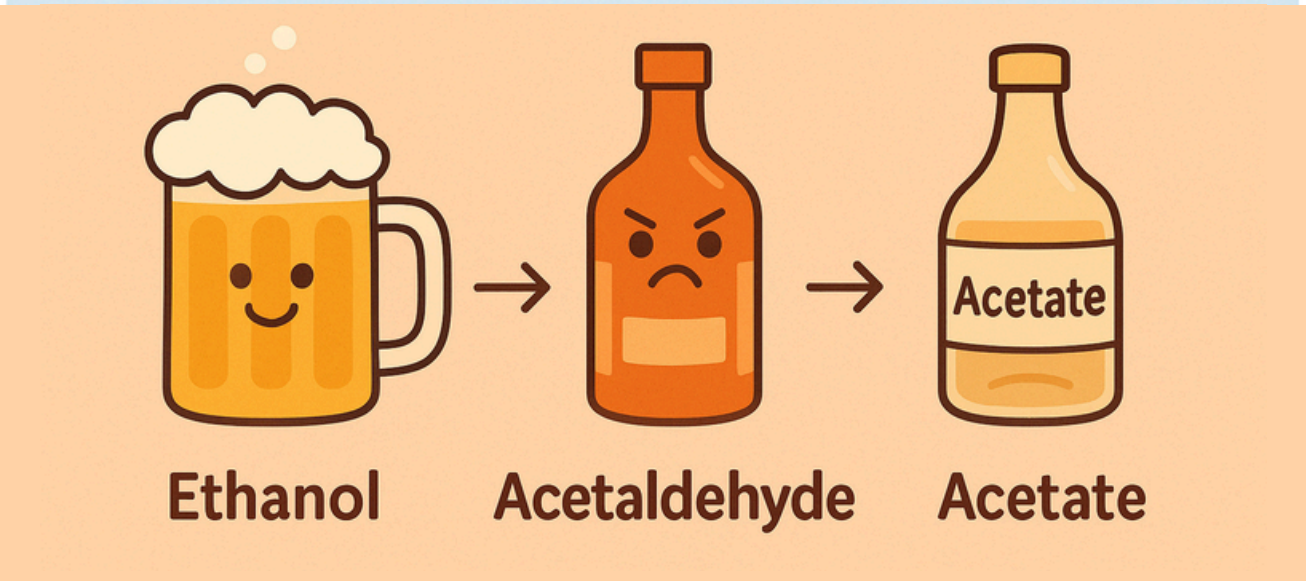
Quick Memory Hook:

LDL: Little Delivery of Lipid (into artery walls)!

Fast Fact 25:

Basic Principle of Ethanol Metabolism

Alcohol journey: happy ➔ toxic ➔ tired.



Ethanol → Acetaldehyde (via alcohol dehydrogenase) → Acetate (via acetaldehyde dehydrogenase).

Why it Matters:

- Acetaldehyde is toxic = hangover symptoms.
- Disulfiram inhibits acetaldehyde dehydrogenase (worse symptoms).

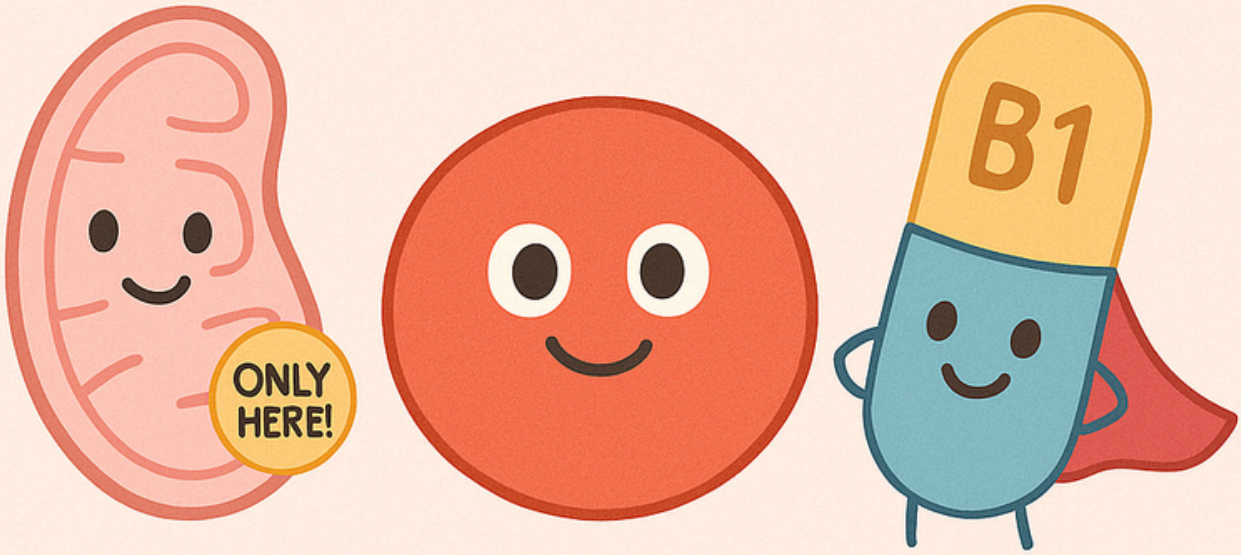
Pro Tip:

If you block acetaldehyde breakdown, you get instant hangover horror.

Quick Memory Hook:

Happy to toxic to tired: the 3-act alcohol play!

Thank You



Follow us