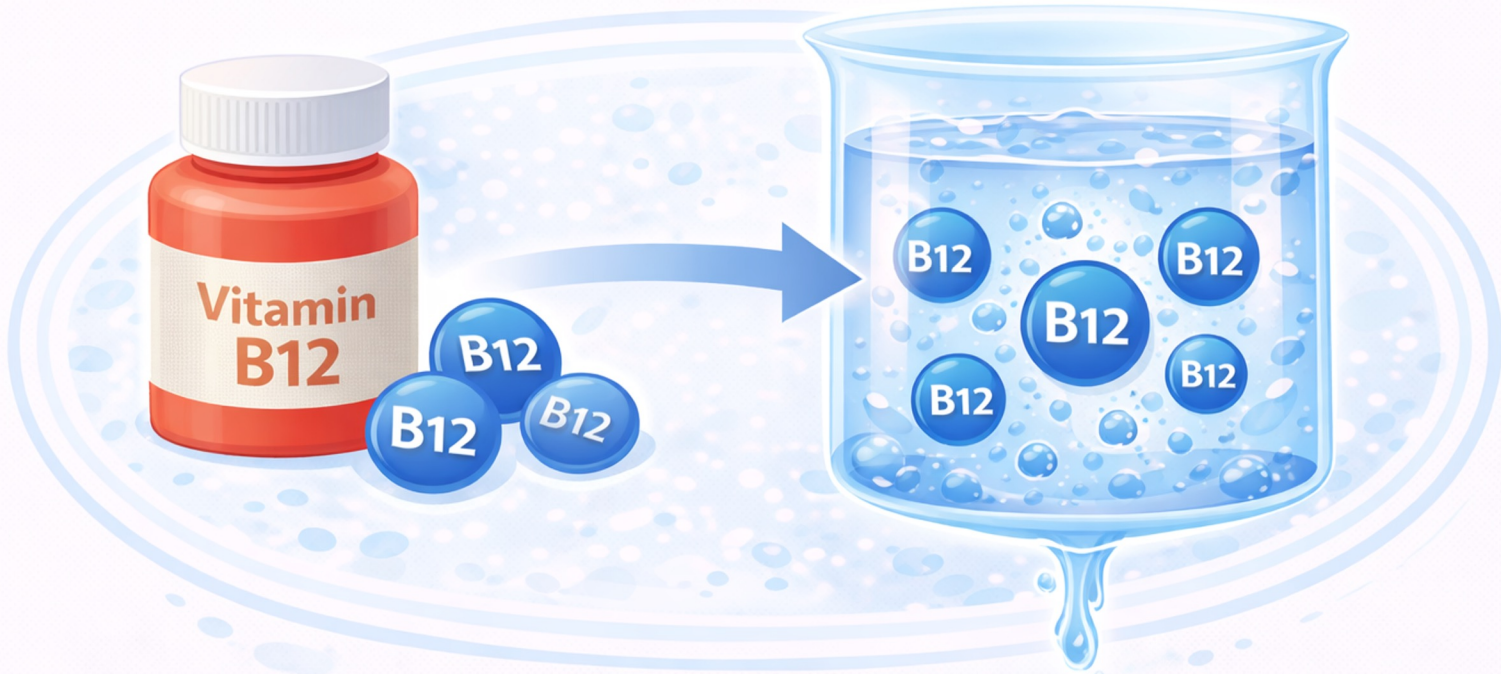
BOOST YOUR VITAMIN B12

B12 B12 B12 B12

Easy B12 ABSORPTION!

Vitamin B12 Is Water Soluble

B12 dissolves in water and does not get stored in the body.

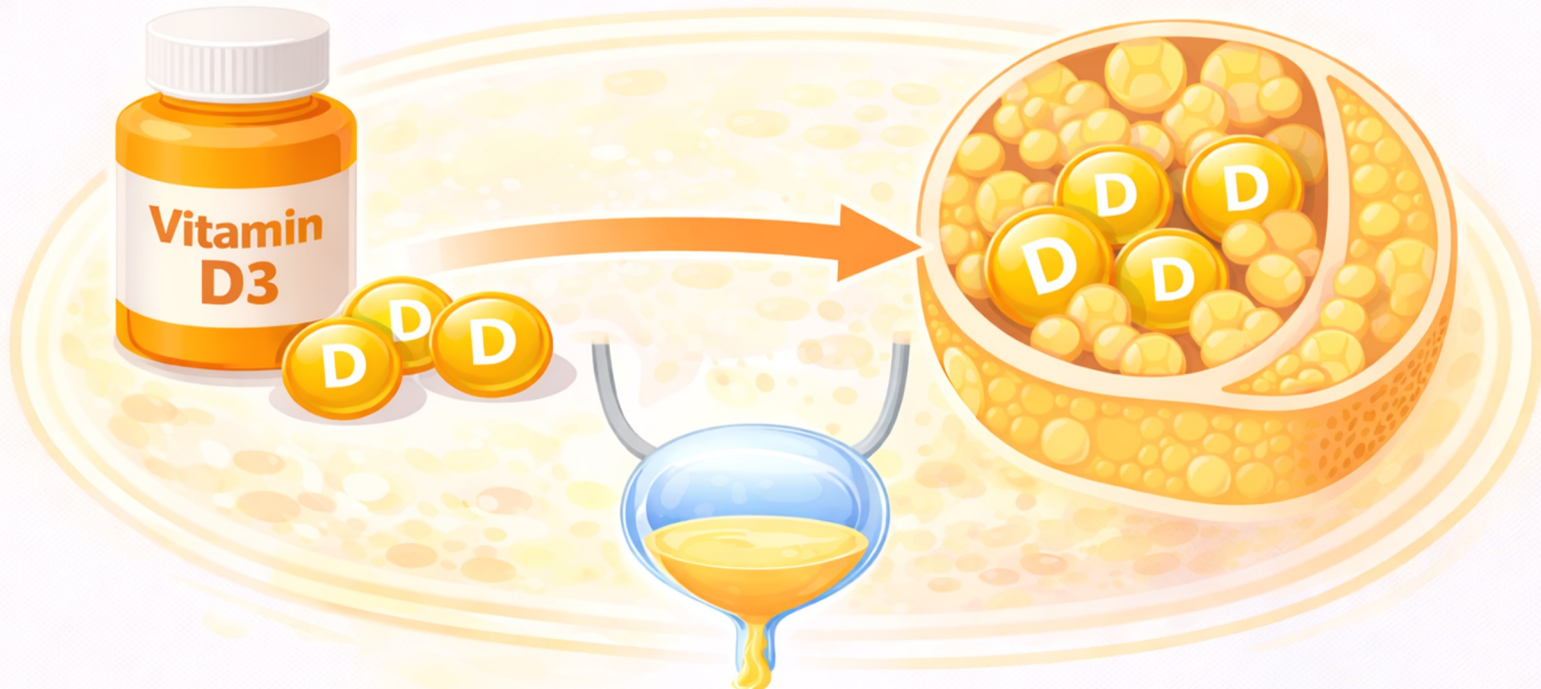


Extra B12 dissolves in water and is flushed out in the urine.

https://gemini.google.com/share/6dfe767e483e

Vitamin D Is Fat Soluble

Vitamin D dissolves in fat and is stored in the body.



Vitamin D *is not excreted in the urine.*

Dr Hugh's labs

Vitamin B12

Test	Current Result and Flag		Previous Result and Date		Units	Reference Interval
▲ **Vitamin B12** [01]	**1546**	**High**	**1279**	12/05/2024	pg/mL	232-1245

Homocyst(e)ine

Test	Current Result and Flag		Previous Result and Date		Units	Reference Interval
▲ **Homocyst(e)ine** [01]	**16.6**	**High**	11.5	12/12/2024	umol/L	0.0-14.5

Uric Acid

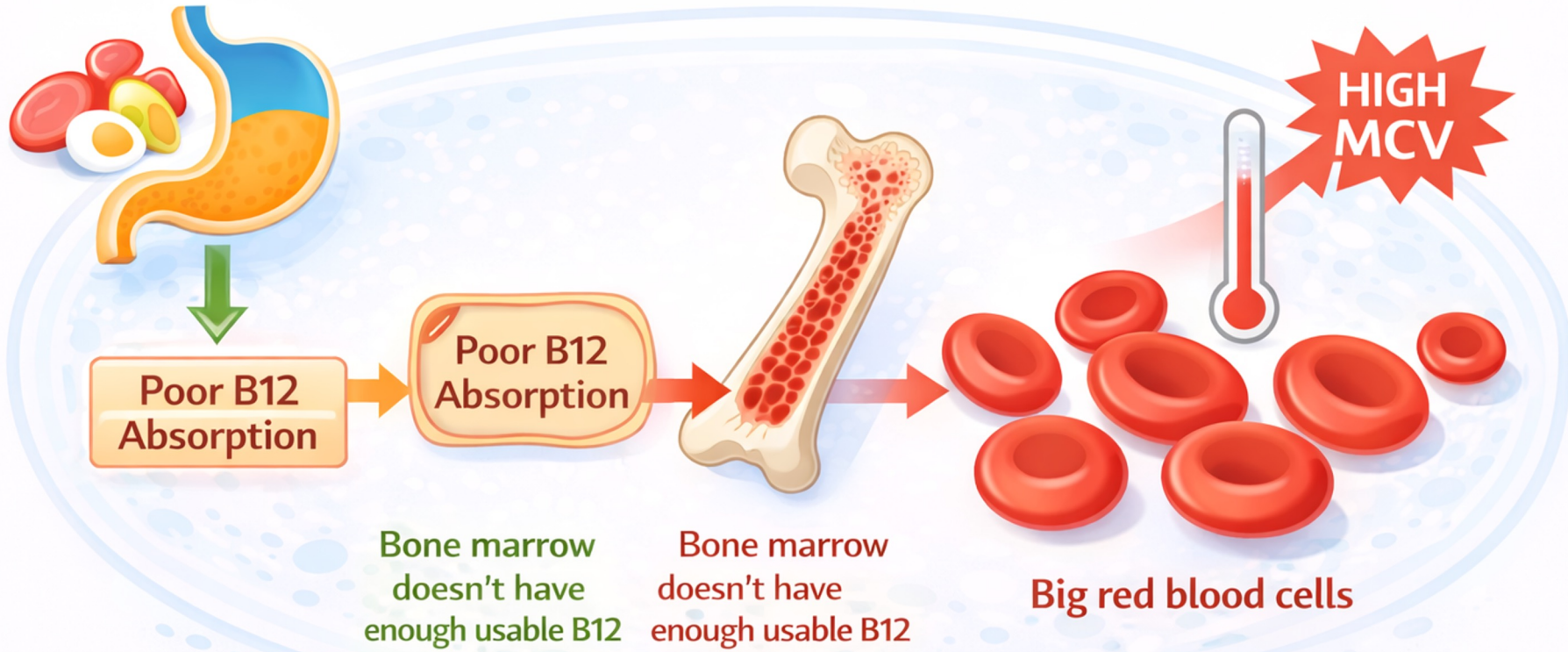

WHAT B12 DOES IN YOUR BODY
Energy Production
Nerve Health
Red Blood Cells
Memory & Brain Function
Liver Health
B12
Heart Health
Healthy Nerves
DNA Synthesis
Immune Function
Digestive Health

5. Summary Table: B12 Biological Requirements

System	Role of B12	Clinical Consequence of Deficiency
Neurological	Myelin maintenance & neurotransmitter synthesis	Peripheral Neuropathy, brain fog, depression
Hematological	DNA synthesis in red blood cells	**Megaloblastic Anemia**, fatigue, shortness of breath
Cardiovascular	Lowering Homocysteine	Increased risk of blood clots and **CVD**
Metabolic	Conversion of fats/proteins to ATP	Mitochondrial dysfunction, chronic fatigue
Dermatological	Cell turnover in skin/nails/hair	Hyperpigmentation, vitiligo, hair loss

Poor B12 Absorption Can Lead to Large Red Blood Cells

Not absorbing enough B12 can cause problems making normal-sized red blood cells.



Your body is not pulling in enough B12 from food, so it has trouble making normal-sized red cells.

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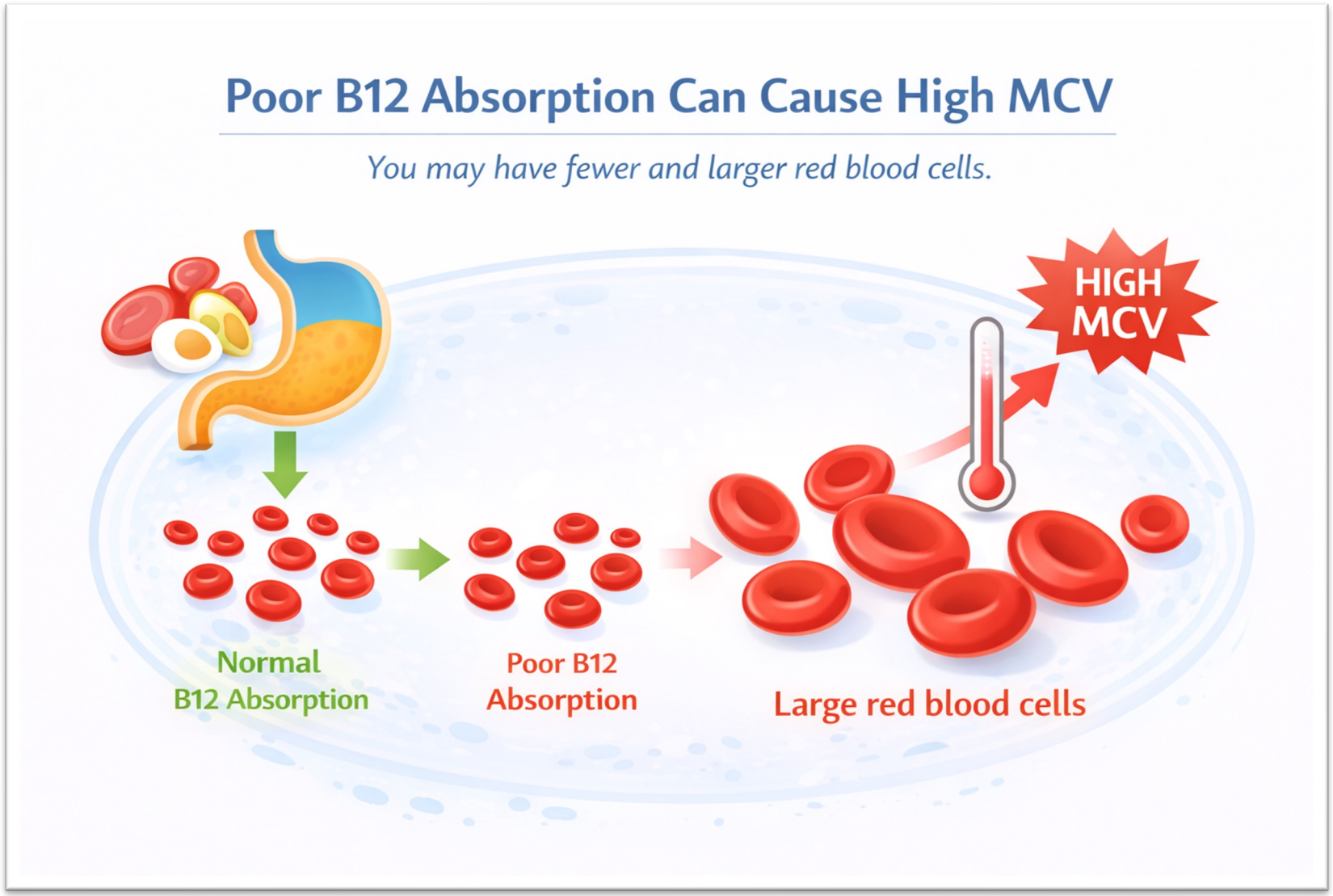
▲	MCV[01]	100	High	fL	79-97

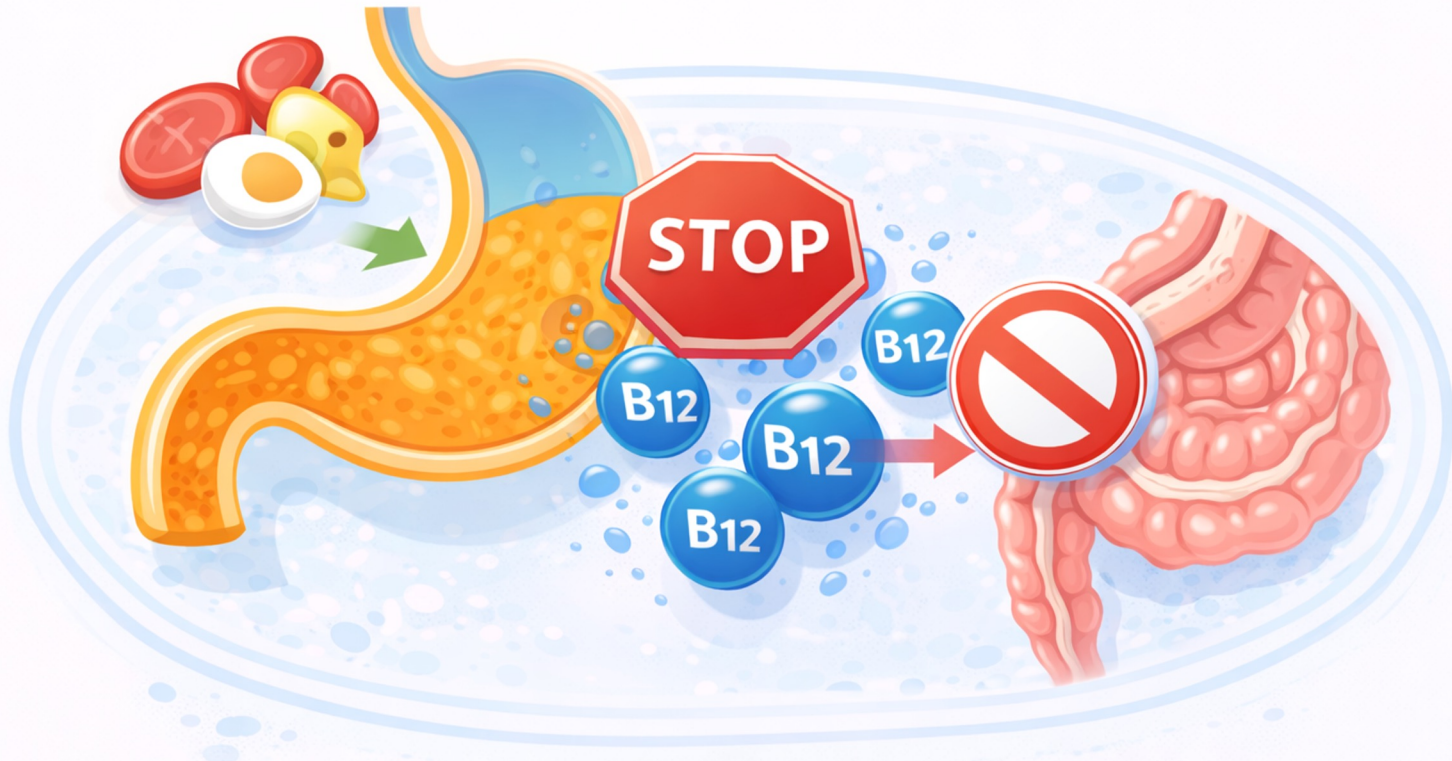


CBC With Differential/Platelet

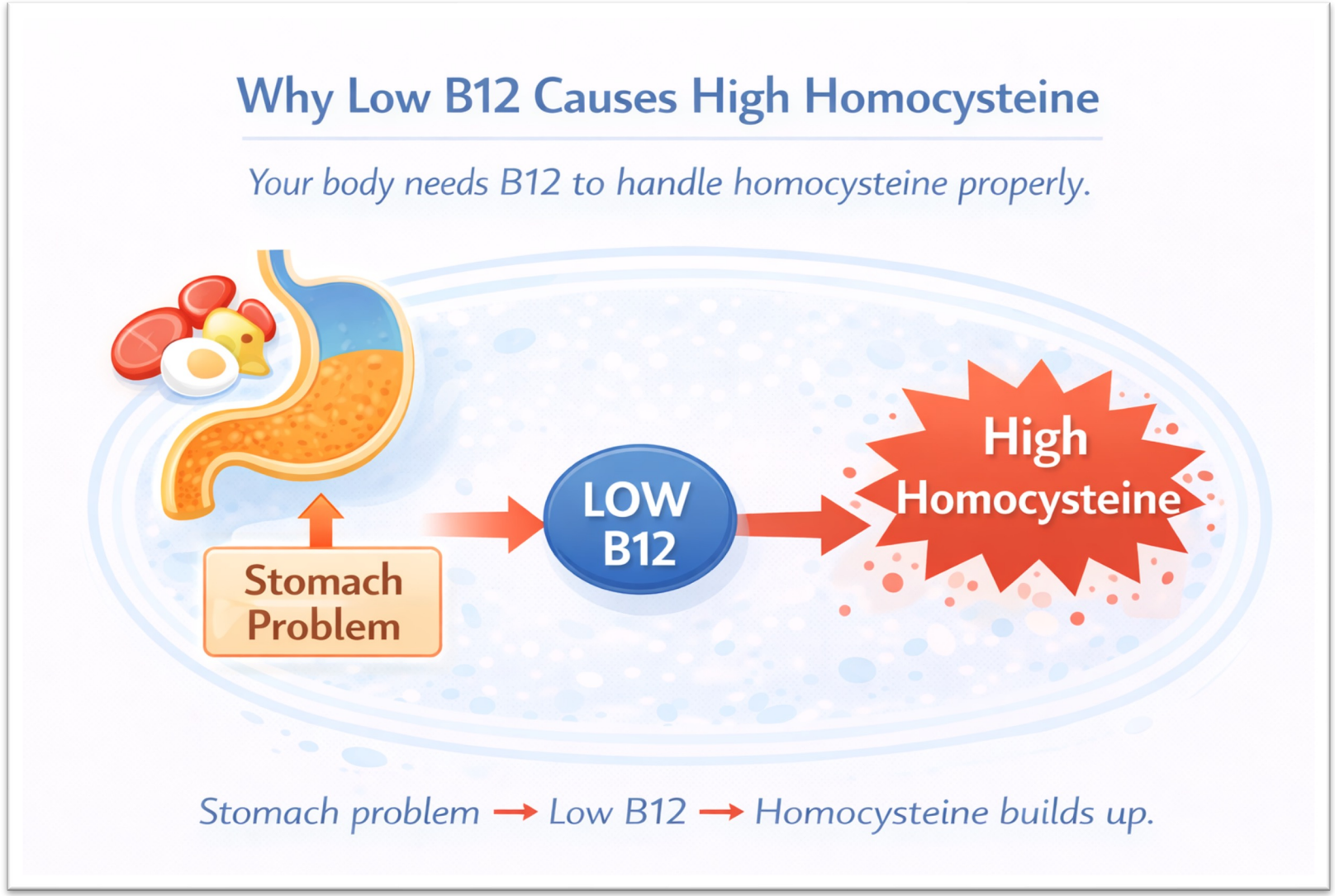
Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
WBC [01]	5.6		x10E3/uL	3.4-10.8
RBC [01]	5.30		x10E6/uL	4.14-5.80
Hemoglobin [01]	15.2		g/dL	13.0-17.7
Hematocrit [01]	48.2		%	37.5-51.0
MCV [01]	91		fL	79-97
MCH [01]	28.7		pg	26.6-33.0
MCHC [01]	31.5		g/dL	31.5-35.7
RDW [01]	13.7		%	11.6-15.4

▲	**MCV** [01]	**100**	**High**	fL	79-97

B12 Not Absorbed Through the Stomach



Your body cannot pull B12 in from the digestive system.



Homocyst(e)ine

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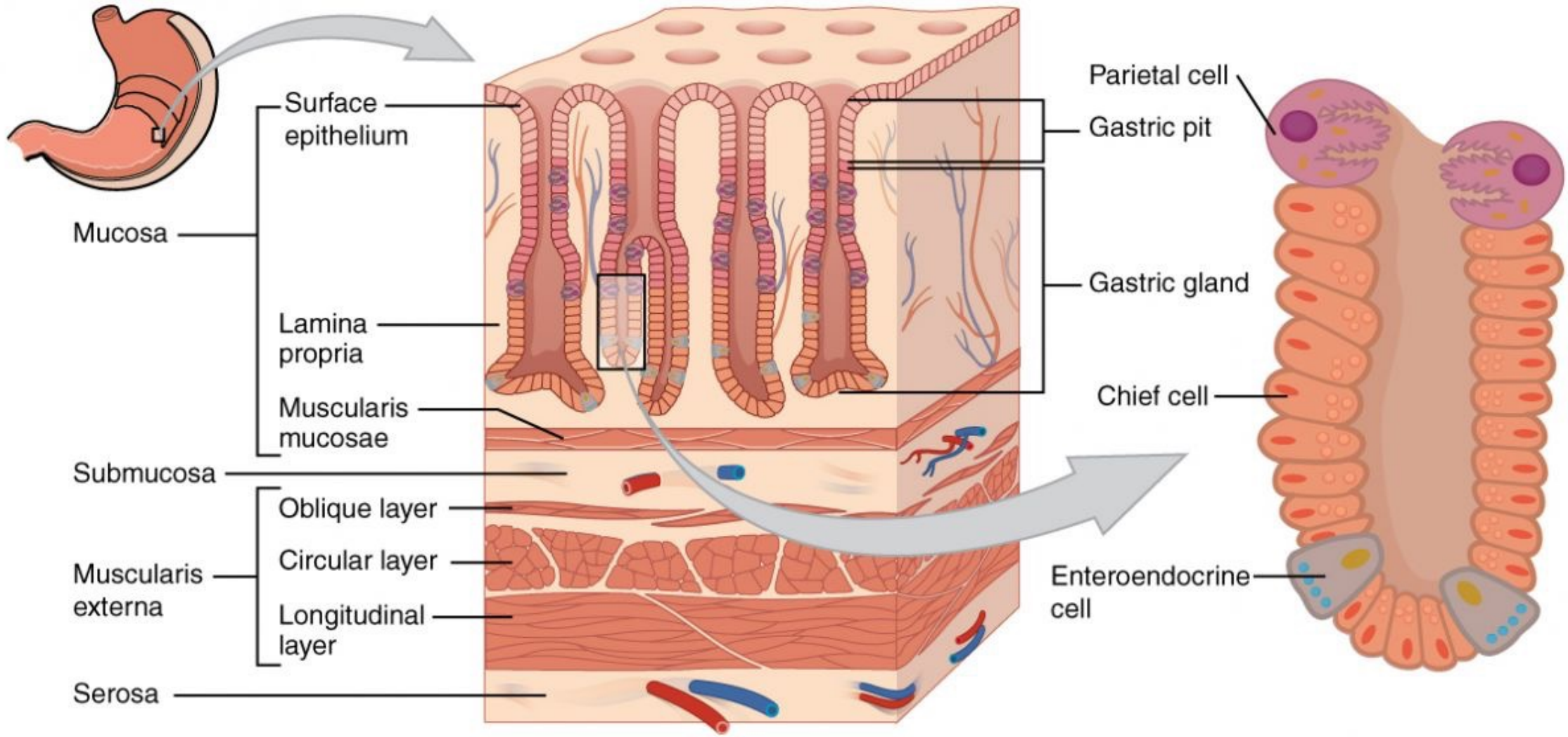
▲	**Homocyst(e)ine** [01]	**15.6**	**High**		umol/L	0.0-11.0

Homocyst(e)ine

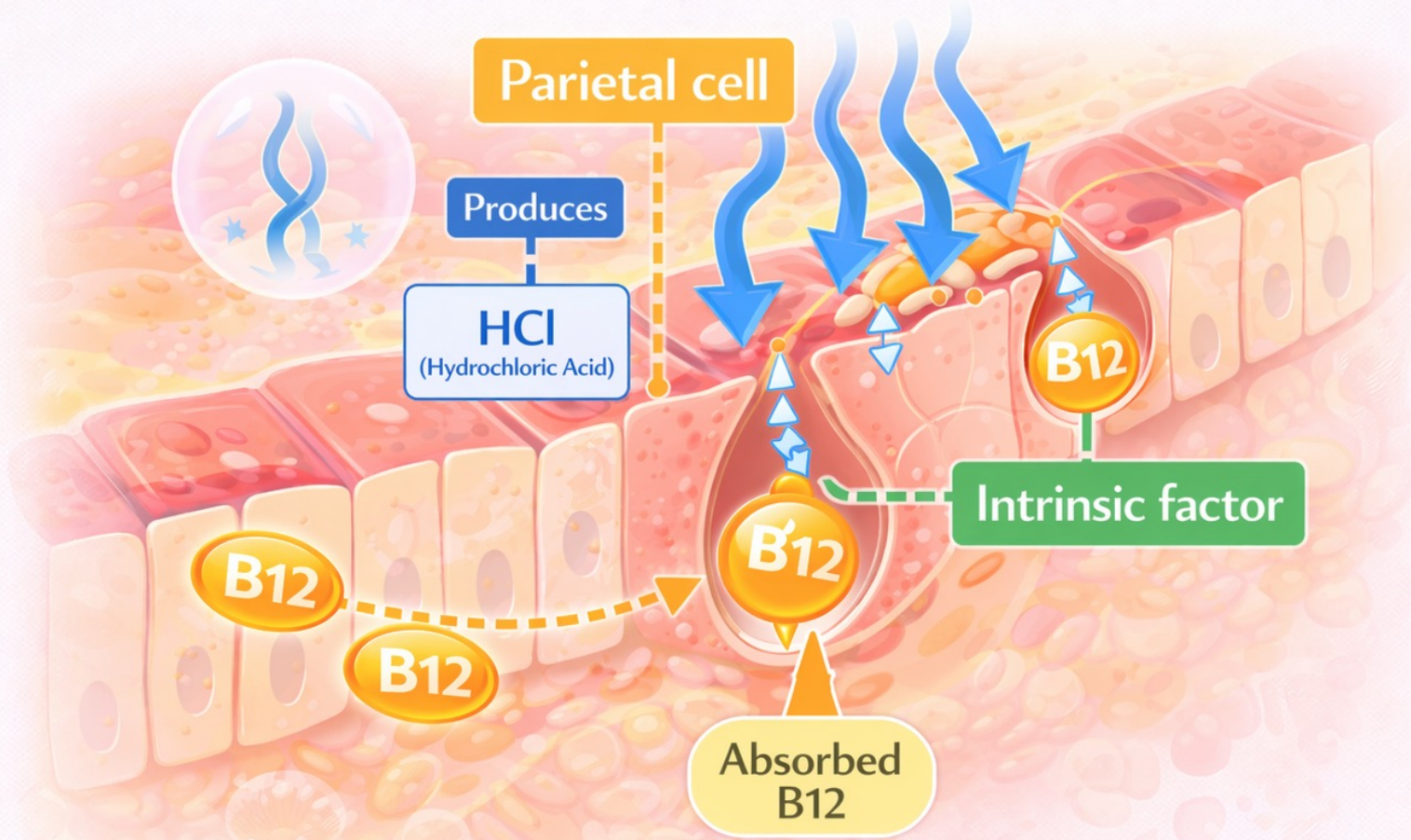
	Test	Current Result and Flag		Previous Result and Date		Units	Reference Interval
▲	**Homocyst(e)ine** [02]	**64.6**	**High**	**69.2**	04/01/2025	umol/L	0.0-14.5
		Results confirmed on dilution.					

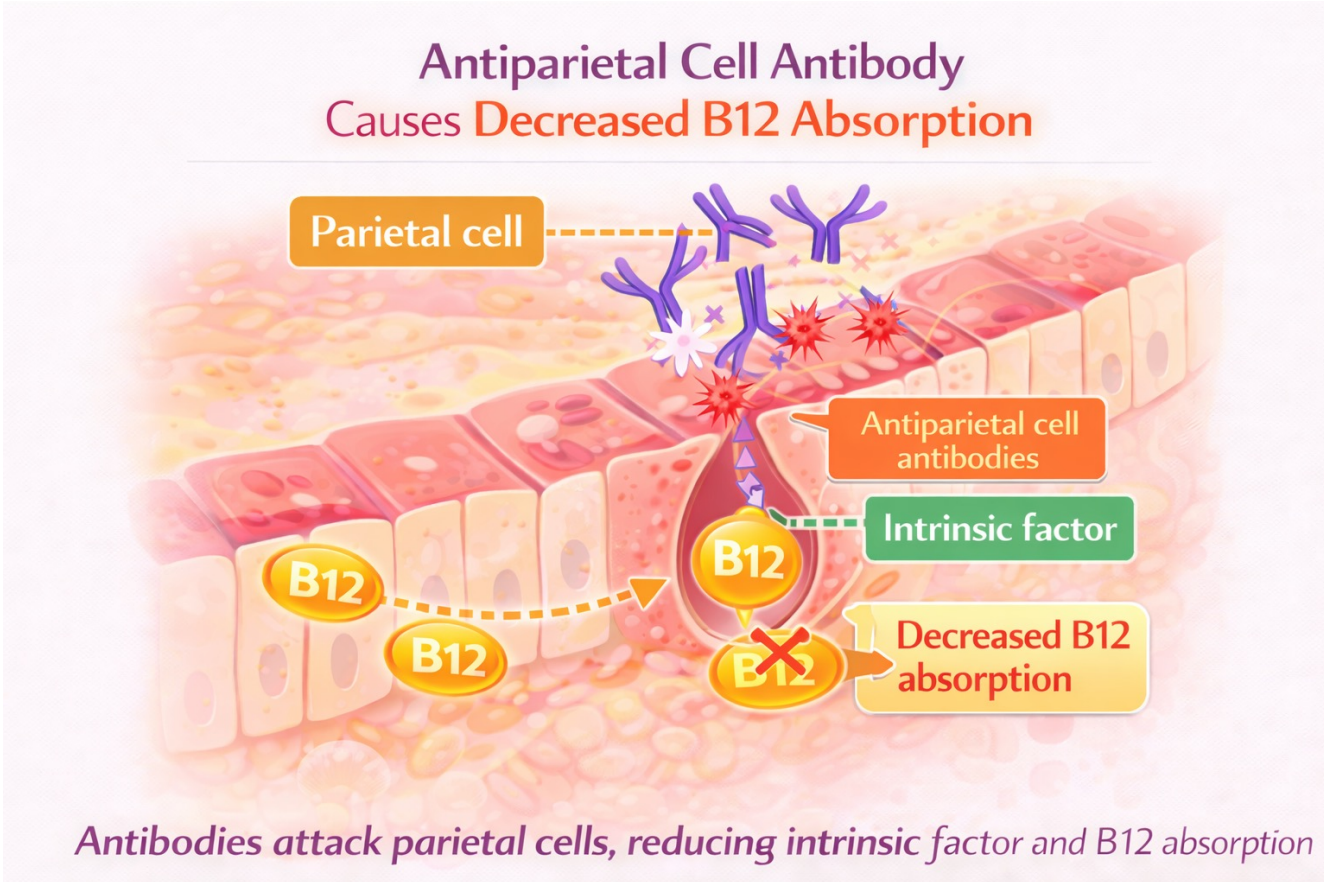
Homocyst(e)ine

Test	Current Result and Flag	Previous Result and Date		Units	Reference Interval
Homocyst(e)ine [01]	12.0	**64.6**	04/03/2025	umol/L	0.0-14.5


Surface epithelium
Mucosa
Lamina propria
Muscularis mucosae
Submucosa
Oblique layer
Muscularis externa
Circular layer
Longitudinal layer
Serosa
Parietal cell
Gastric pit
Gastric gland
Chief cell
Enteroendocrine cell

Parietal Cells Absorb Vitamin B12





Antiparietal Cell Antibody

	Test	Current Result and Flag		Previous Result and Date	Units	Reference Interval
▲	**Antiparietal Cell Antibody** [03]	**27.8**	**High**		Units	0.0-20.0

Negative 0.0 - 20.0
Equivocal 20.1 - 24.9
Positive >24.9

Parietal Cell Antibodies are found in 90% of patients with pernicious anemia and 30% of first degree relatives with pernicious anemia.

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Antiparietal Cell Antibody [03]	8.0		Units	0.0-20.0

Negative 0.0 - 20.0
Equivocal 20.1 - 24.9
Positive >24.9

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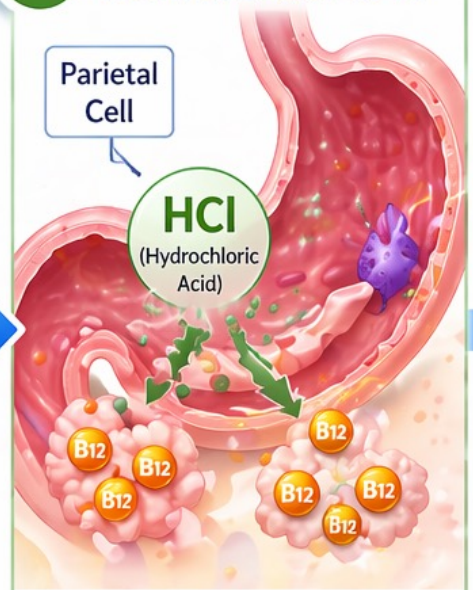
HOW VITAMIN B12 IS ABSORBED

A 4-Step Journey from Food to Your Body

1 FOOD B12

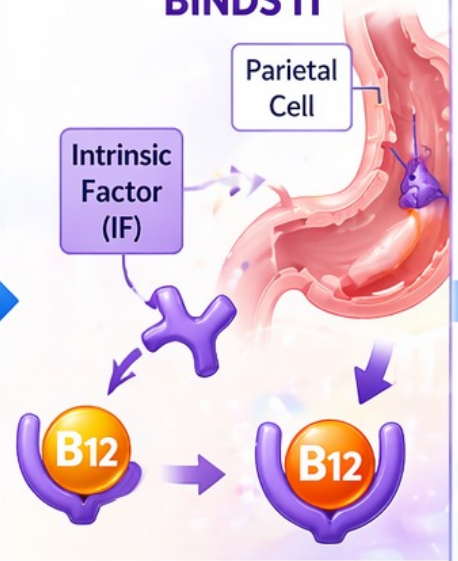
Vitamin B12 is bound to protein in the food you eat.

2 HCl RELEASES IT



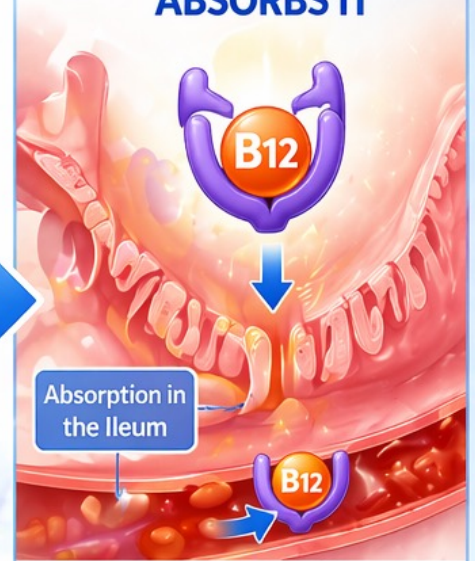
Hydrochloric acid (HCl) from parietal cells releases B12 from food proteins.

3 INTRINSIC FACTOR BINDS IT



Intrinsic factor (IF) produced by parietal cells binds to B12, protecting it and preparing it for absorption.

4 SMALL INTESTINE ABSORBS IT



In the ileum (part of the small intestine), the B12–intrinsic factor complex is absorbed into the bloodstream.

Food B12 → HCl releases it → Intrinsic factor binds it → Small intestine absorbs it

How B12 Supports the MTHFR Pathway

B12 helps the pathway work better when MTHFR is working properly.

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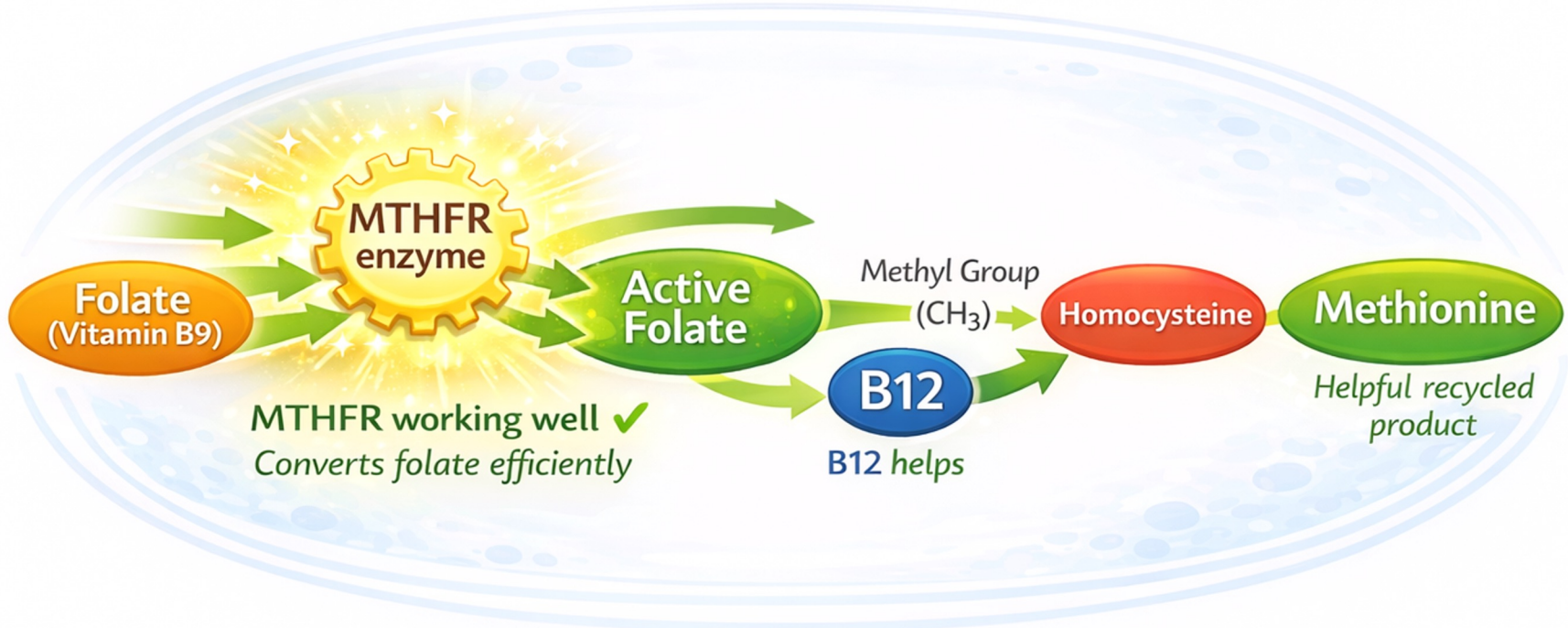

MTHFR *makes active folate.* **B12 helps use it** *properly.*

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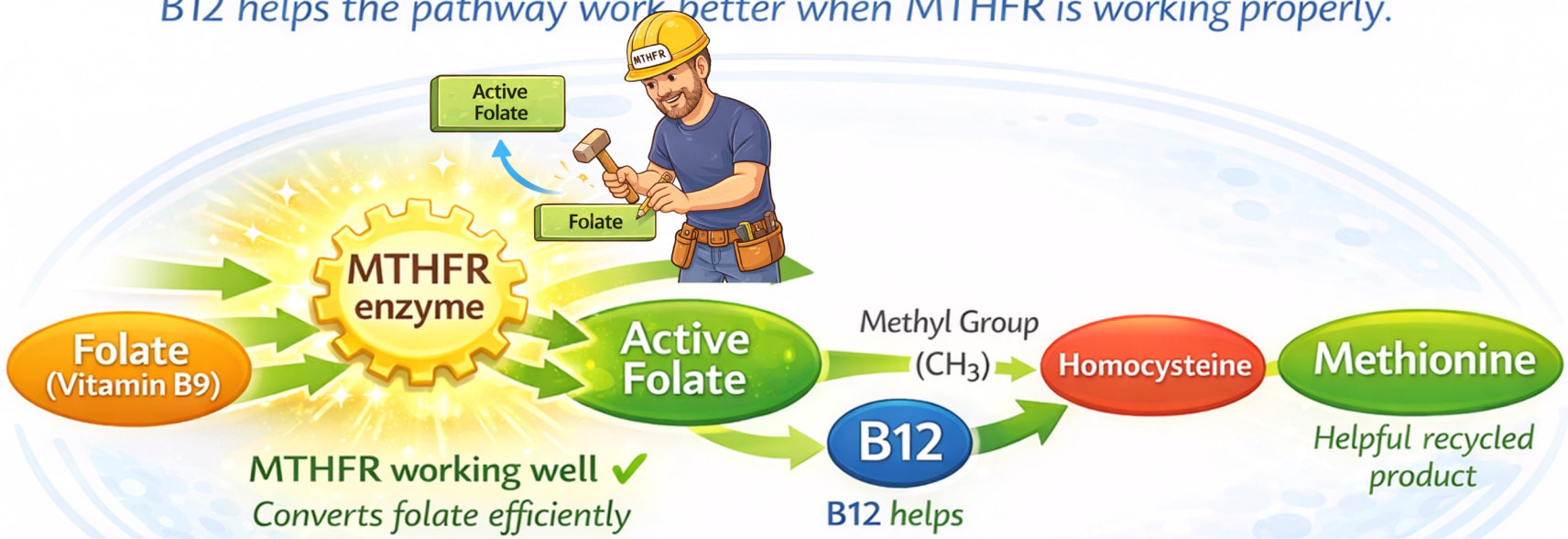
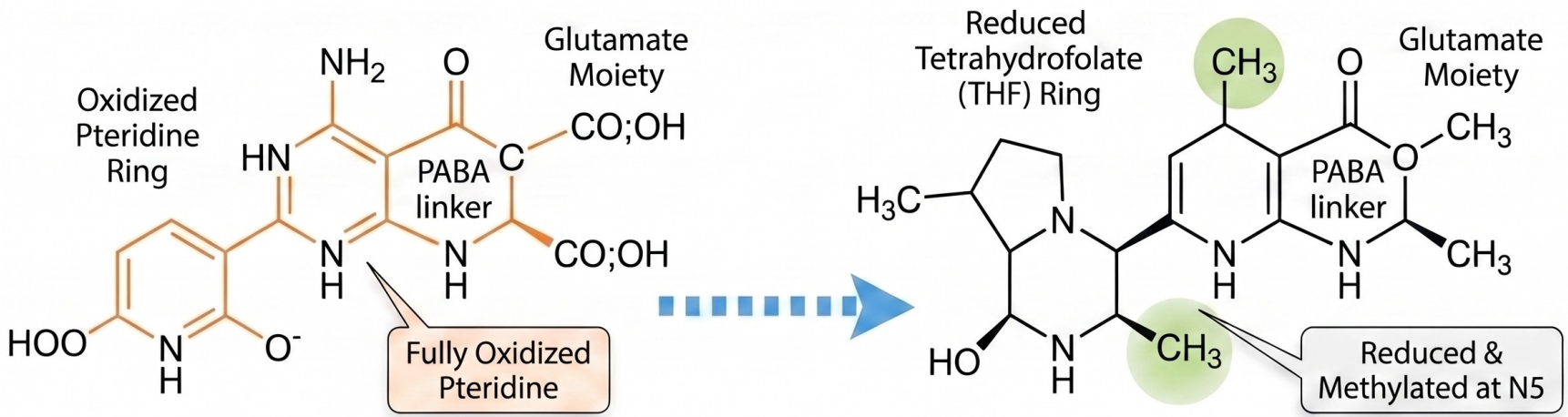


MTHFR *makes active folate.* **B12 helps use it** *properly.*

The Difference Between **Folate** and Active Folate



Folate (Vitamin B9)

Inactive Form

Must be converted to active form

Active Folate

Usable Form

Already converted, ready for use

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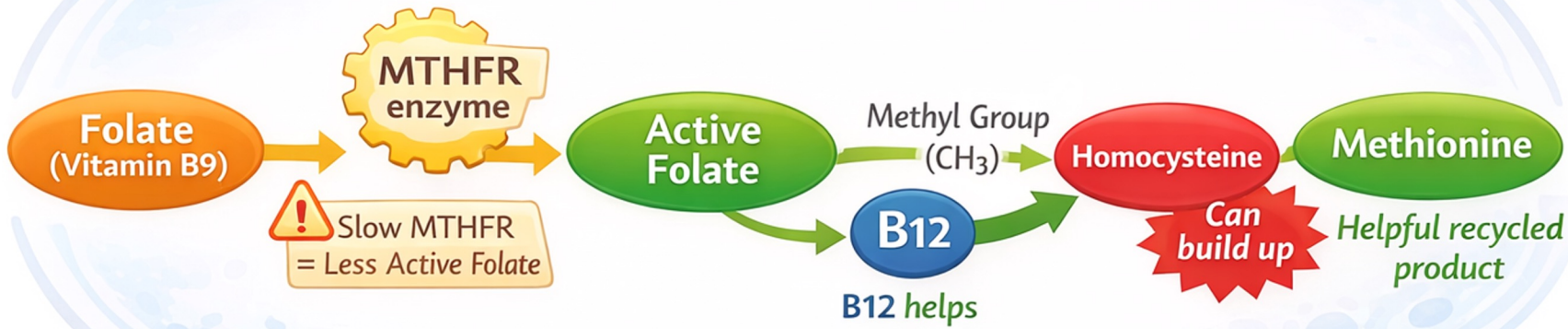
B12 helps the pathway work better.



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Homocyst(e)ine

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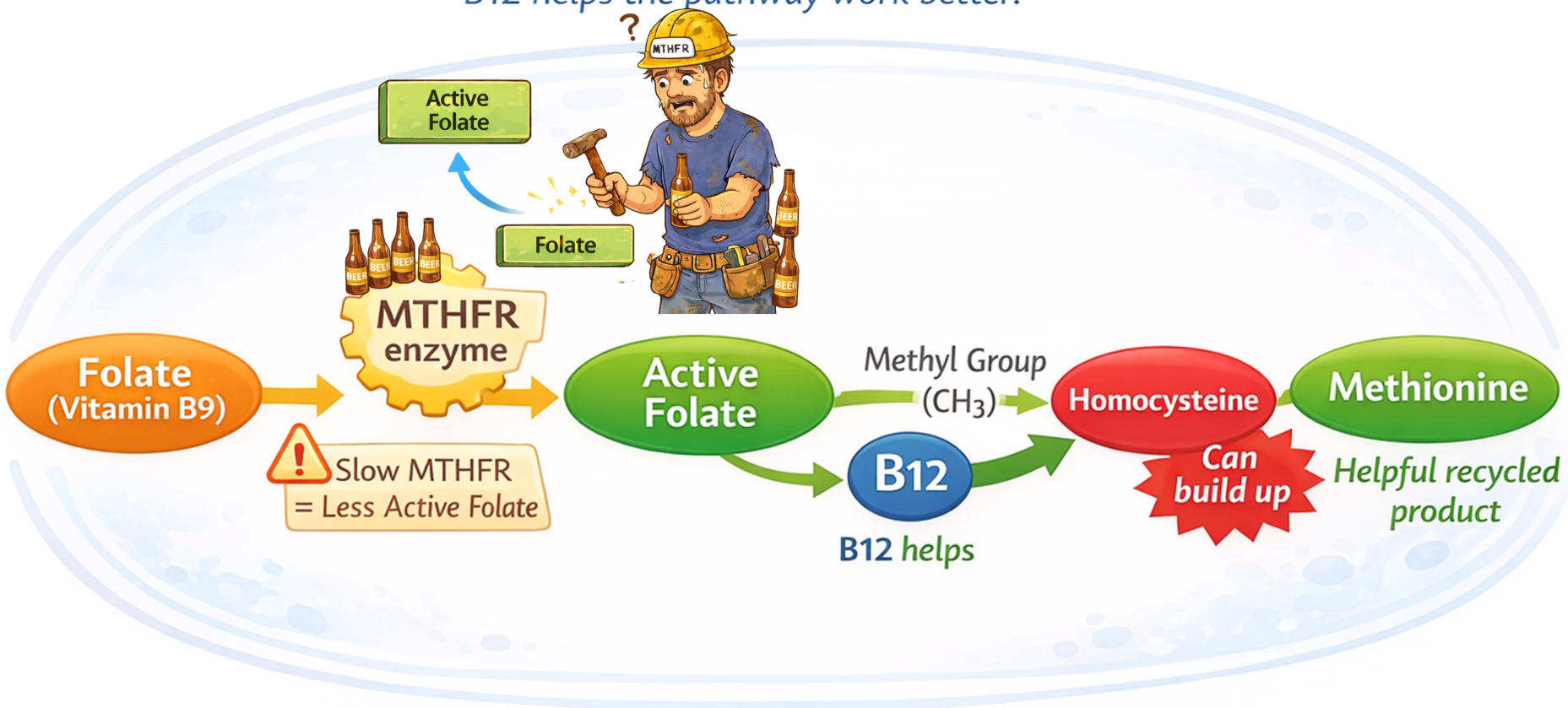

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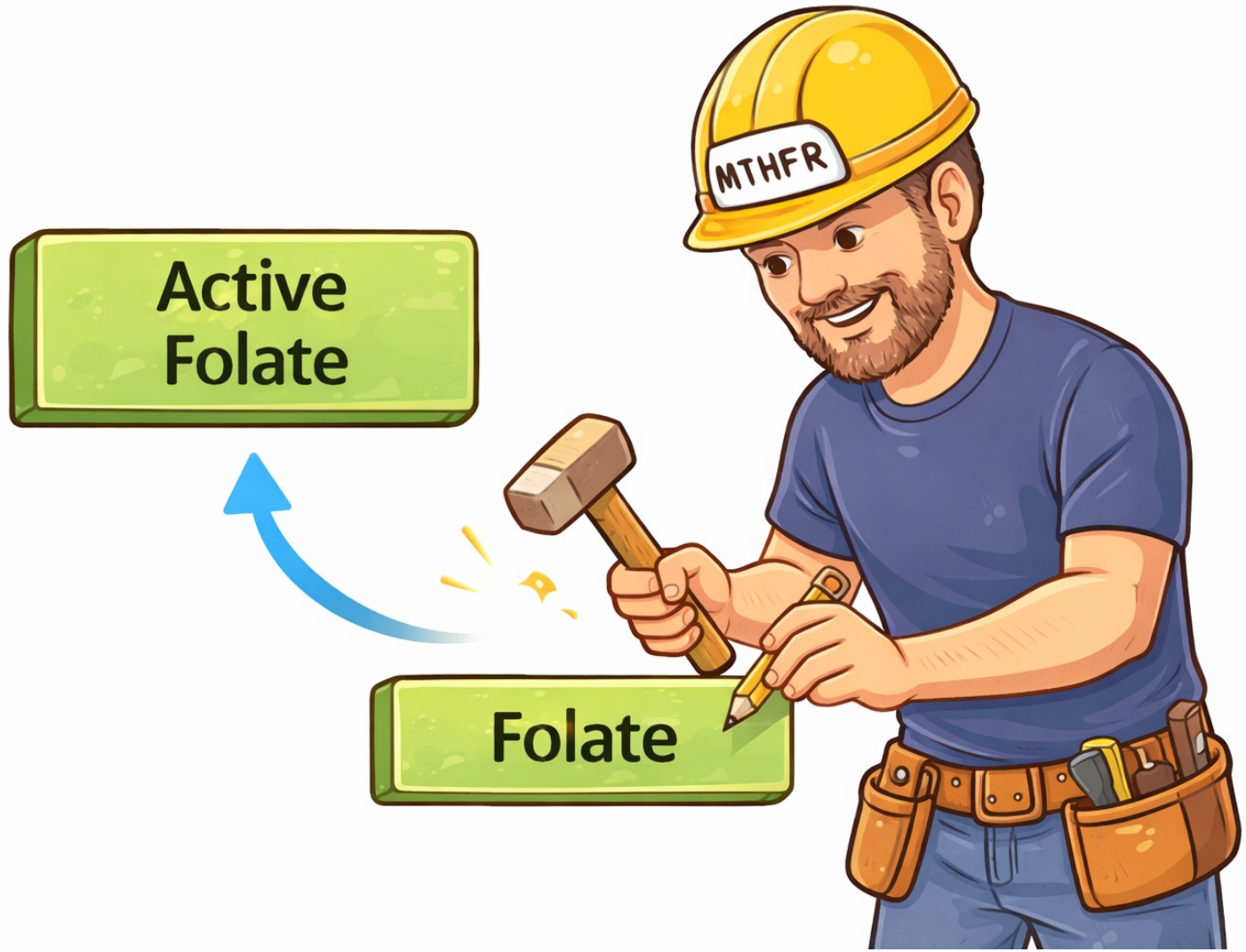
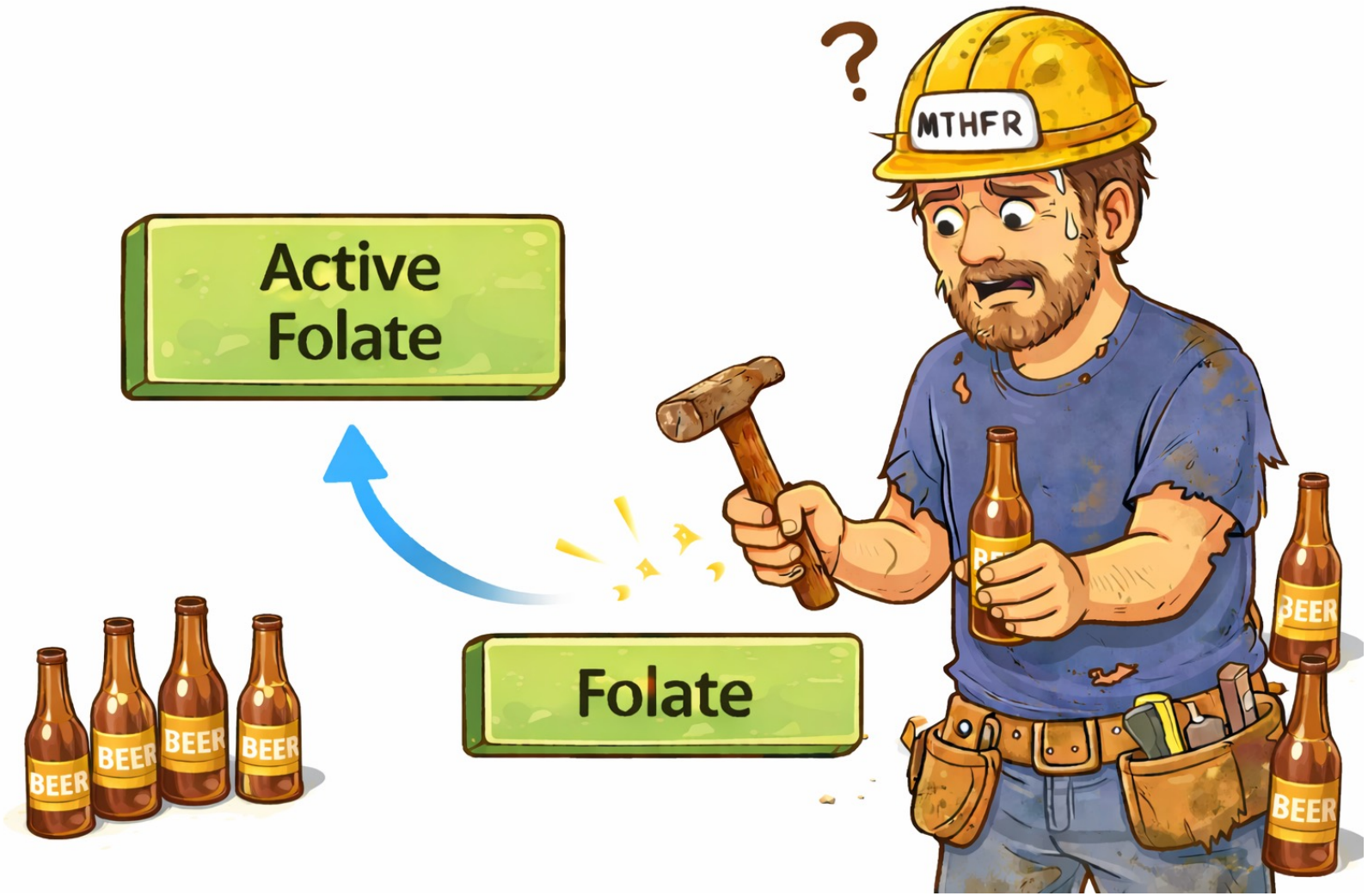

Active
Folate
MTHFR
Folate


Active
Folate
Folate
MTHFR
?
BEER
BEER
BEER
BEER
BEER
BEER

Methyl Charge+®

Supplement Facts

Serving Size: 1 mL (2 Pumps)
Servings Per Container: 50

	Amount Per Serving	% Daily Value
Riboflavin (as Riboflavin-5-Phosphate)	7mg	538%
Vitamin B6 (as Pyridoxine HCl)	1mg	59%
Folate (as Calcium Folinate)	850mcg DFE	213%
Vitamin B12 (as Methylcobalamin)	500mcg	20833%
Trimethylglycine (betaine)	75mg	**

****Daily Value not established**

Other Ingredients: Water, glycerin, ethanol, highly purified phospholipids, tocofersolan, EDTA (as preservative), natural mixed tocopherols, natural citrus oils, cinnamon bark oil, natural flavoring


WHY B12 STAYS LOW
B12
Hidden Causes

Gastric and Digestive Factors

The stomach is where B12 must be liberated from protein and bound to protective carriers.

- **Hypochlorhydria or Achlorhydria:** Low stomach acid prevents the release of B12 from animal proteins. Without sufficient Hydrochloric Acid (HCl), the enzymatic cleavage of the B12-protein bond cannot occur.
- **Atrophic Gastritis:** Chronic inflammation leads to the thinning of the stomach lining and a loss of parietal cells, which are responsible for producing both stomach acid and IF (Intrinsic Factor).
- **Lack of IF (Intrinsic Factor):** This is a protein produced by the parietal cells in the stomach. IF must bind to B12 for it to be absorbed later in the ileum.
    - **Pernicious Anemia:** An autoimmune condition where the body attacks parietal cells or IF itself.
- **Gastric Surgery:** Procedures like gastric bypass or gastrectomy remove the sections of the stomach where IF is produced and acid digestion occurs.

https://gemini.google.com/share/d51eb4cc023f

Intestinal and Absorption Site Issues

Even if B12 is properly "packaged" in the stomach, the small intestine must be healthy enough to take it up.

- **Ileal Disease or Resection:** B12 is absorbed specifically in the terminal ileum (the end of the small intestine). Conditions like Crohn's disease or surgical removal of the ileum directly stop absorption.
- **SIBO (Small Intestinal Bacterial Overgrowth):** Excess bacteria in the small intestine can "hijack" or consume the B12 before the body has a chance to absorb it.
- **Celiac Disease:** Chronic gluten exposure in sensitive individuals causes villous atrophy, flattening the intestinal lining and reducing the surface area available for nutrient uptake.
- **Parasitic Infections:** Certain parasites, specifically the fish tapeworm (*Diphyllobothrium latum*), compete with the host for B12.

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Enzyme and Accessory Organ Dysfunction

- **Pancreatic Insufficiency:** Pancreatic enzymes are required to degrade "R-binders" (proteins that protect B12 in the stomach) so that the B12 can transfer over to IF. Without these enzymes, B12 remains stuck to the R-binder and cannot be absorbed.
- **Liver and Gallbladder Issues:** While primarily a storage site, systemic health of the biliary system impacts the overall pH of the small intestine, which can influence the binding affinity of B12 to IF.

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Genetic and Lifestyle Factors

- **MTHFR (Methylenetetrahydrofolate Reductase) Mutations:** While MTHFR primarily affects folate, it is part of the methylation cycle that involves B12. Genetic snips can affect how the body utilizes and "recycles" B12.
- **Excessive Alcohol Consumption:** Alcohol causes inflammation of the GI (Gastrointestinal) tract and interferes with the transport of B12.

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1. Neurological Health and Myelination

B12 is perhaps most famous for its role in the **CNS (Central Nervous System)** and **PNS (Peripheral Nervous System)**.

- **Myelin Sheath Synthesis:** B12 is required to create and maintain the myelin sheath—the fatty insulation that surrounds nerve fibers. Without it, nerves "short circuit," leading to neuropathy or **SACD (Subacute Combined Degeneration)** of the spinal cord.
- **Neurotransmitter Production:** It acts as a co-factor in the synthesis of neurotransmitters like serotonin, dopamine, and norepinephrine, which regulate mood and cognitive function.
- **Prevention of Brain Atrophy:** Research shows that adequate B12 levels are protective against cerebral atrophy (brain shrinking) in the elderly.

2. DNA Synthesis and Cell Division

B12 is a mandatory "partner" for folate in the creation of genetic material.

- **Nucleic Acid Production:** B12 is essential for the synthesis of DNA and RNA. When B12 is missing, cells cannot divide properly.
- **Hematopoiesis (Blood Cell Formation):** The bone marrow is one of the most metabolically active tissues. B12 deficiency leads to **Megaloblastic Anemia**, where red blood cells are too large and immature to function, because the DNA isn't ready for the cell to divide.

3. The Methylation Cycle and Detoxification

As a **Functional Medicine** practitioner, you know B12 is a "spark plug" for the methylation cycle.

- **Homocysteine Regulation:** B12 (as Methylcobalamin) donates a methyl group to homocysteine to convert it back into **Methionine**.
    - **Clinical Impact:** High homocysteine is a major risk factor for **CVD (Cardiovascular Disease)**, stroke, and systemic inflammation.
- **SAMe Production:** By converting homocysteine to methionine, B12 facilitates the production of **SAMe (S-Adenosylmethionine)**, the body's universal methyl donor used for over 200 enzymatic reactions, including liver detoxification and gene expression.

4. Mitochondrial Energy Production

B12 is involved in the "burning" of fats and proteins for fuel.

- **The Krebs Cycle:** B12 (as Adenosylcobalamin) is a co-factor for the enzyme that converts **Methylmalonyl-CoA** into **Succinyl-CoA**. Succinyl-CoA enters the Krebs cycle to produce **ATP (Adenosine Triphosphate)**.
- **Fatty Acid Metabolism:** Without B12, the body cannot properly break down certain fatty acids and amino acids, leading to a buildup of **MMA (Methylmalonic Acid)**, which is toxic to the nervous system.

BOOST YOUR VITAMIN B12

B12

B12

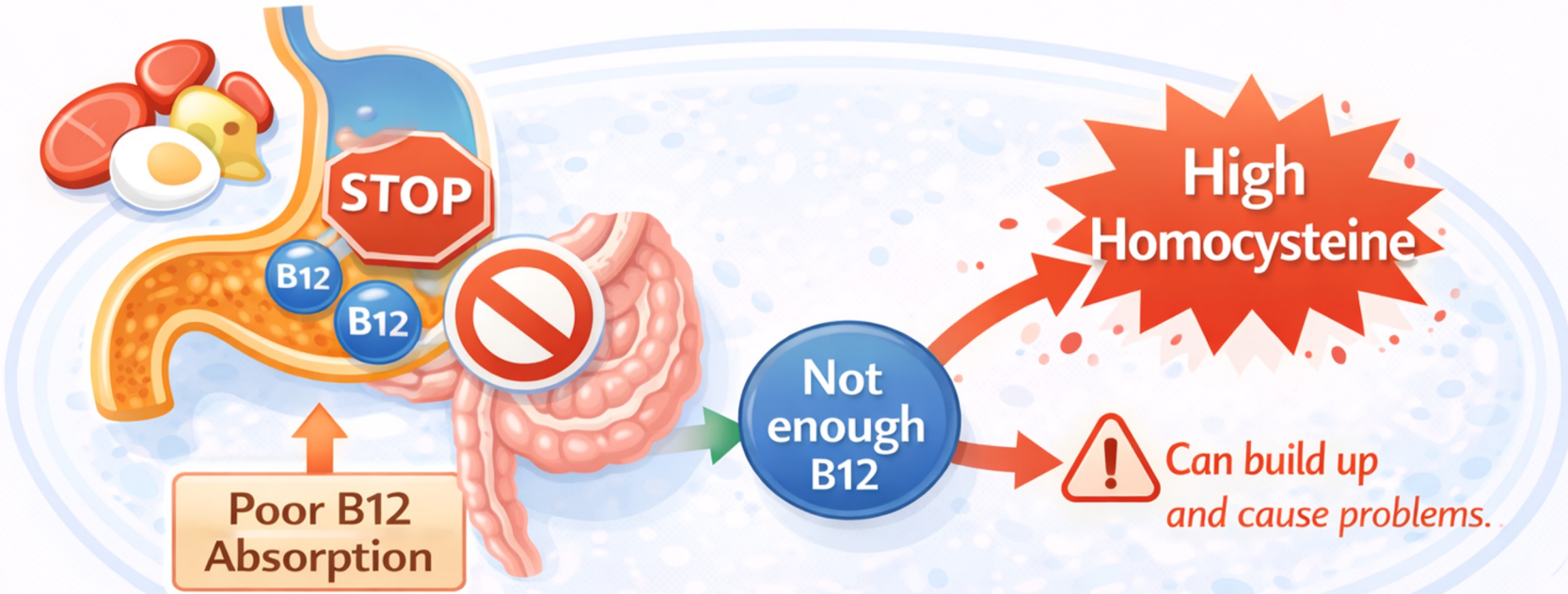
B12

B12

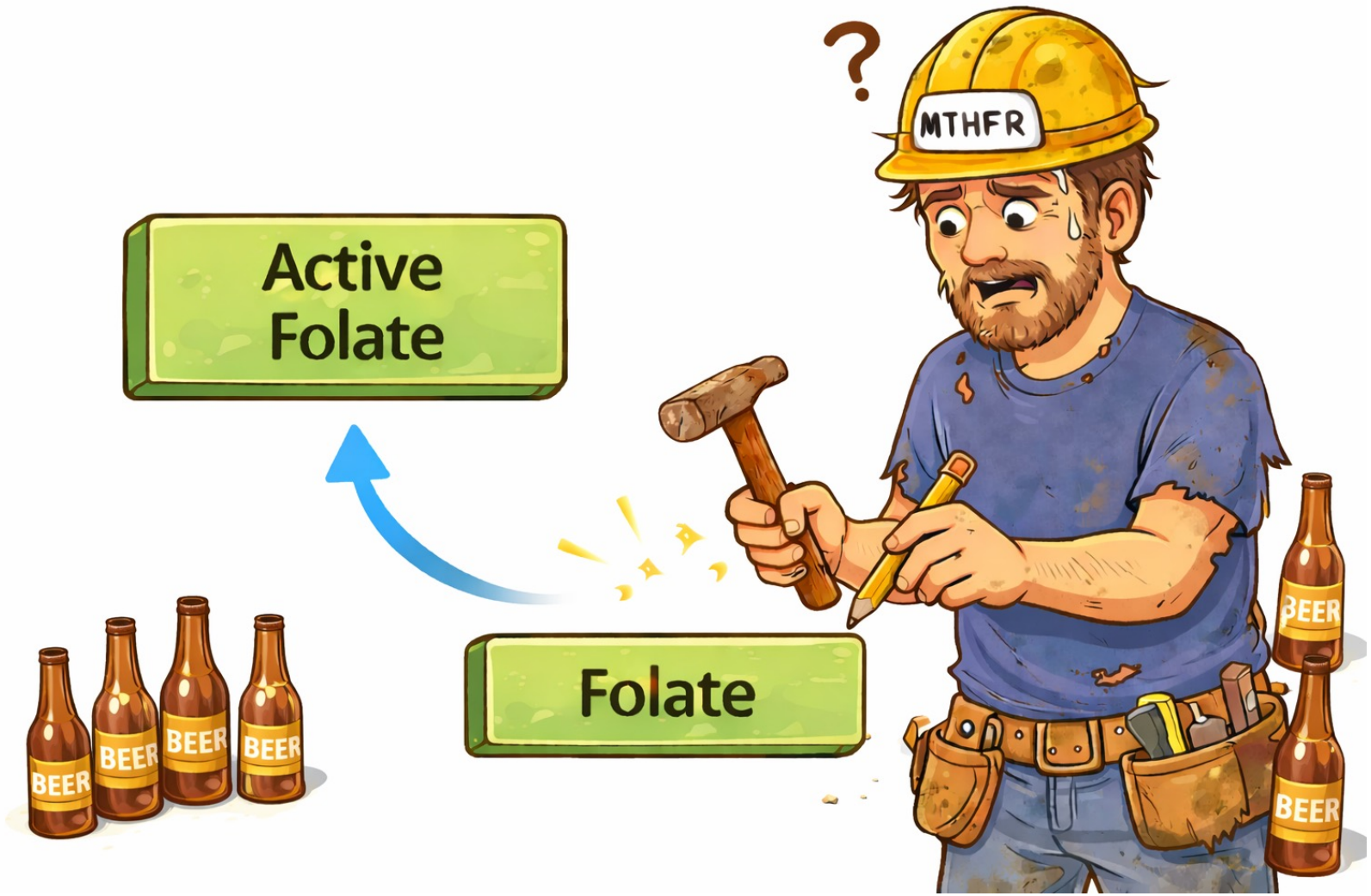
Easy B12 ABSORPTION!

Poor B12 Absorption Can Cause Increased Homocysteine

Not absorbing B12 can lead to more buildup of homocysteine.



When your body is low on usable B12, homocysteine can accumulate.


Active
Folate
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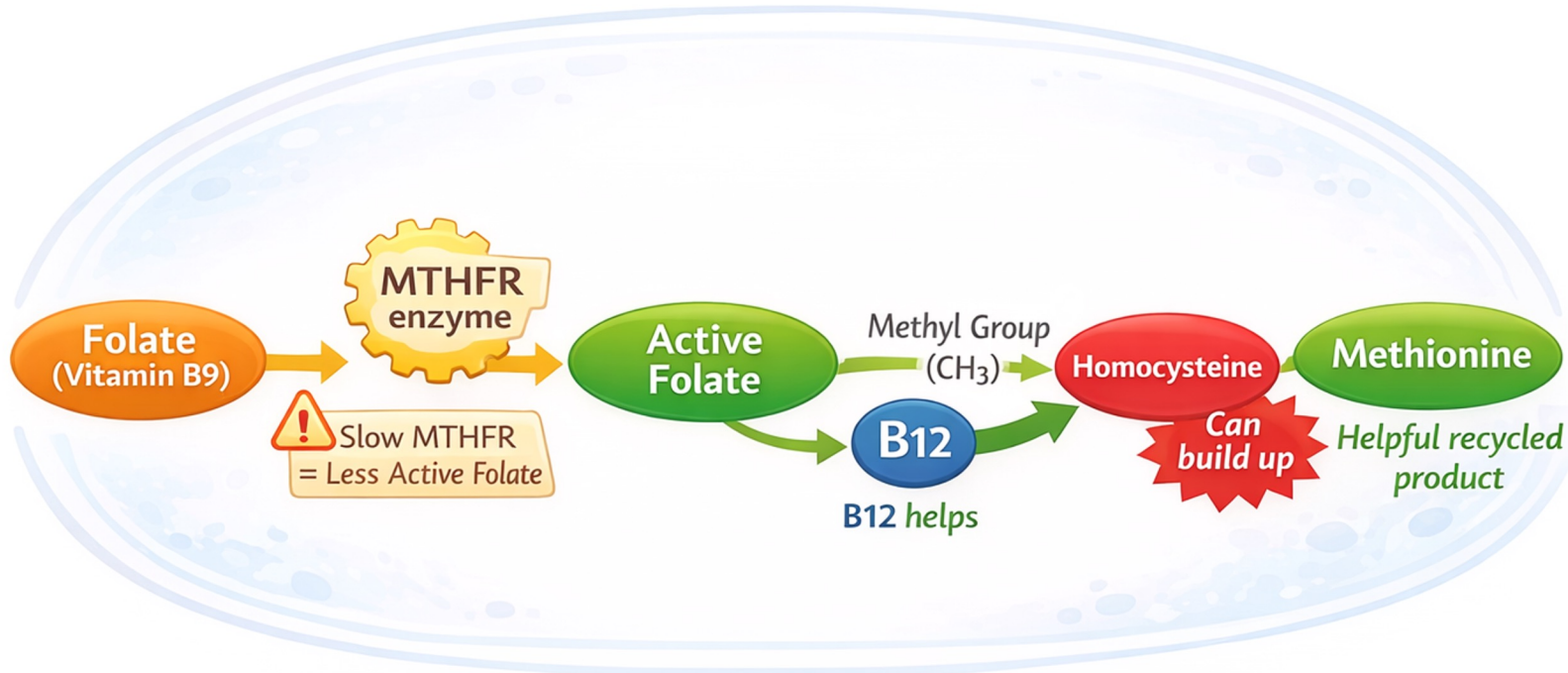

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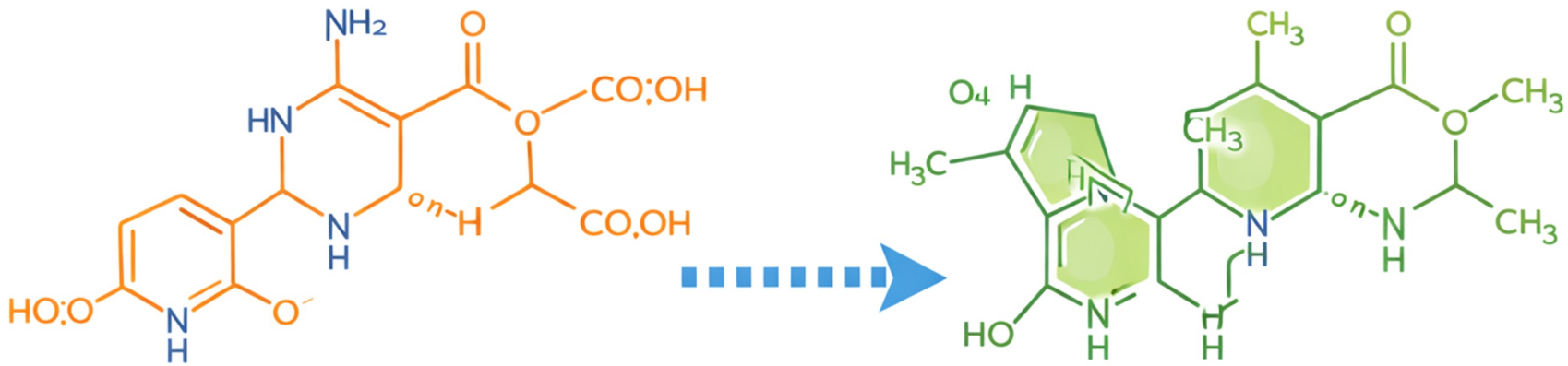

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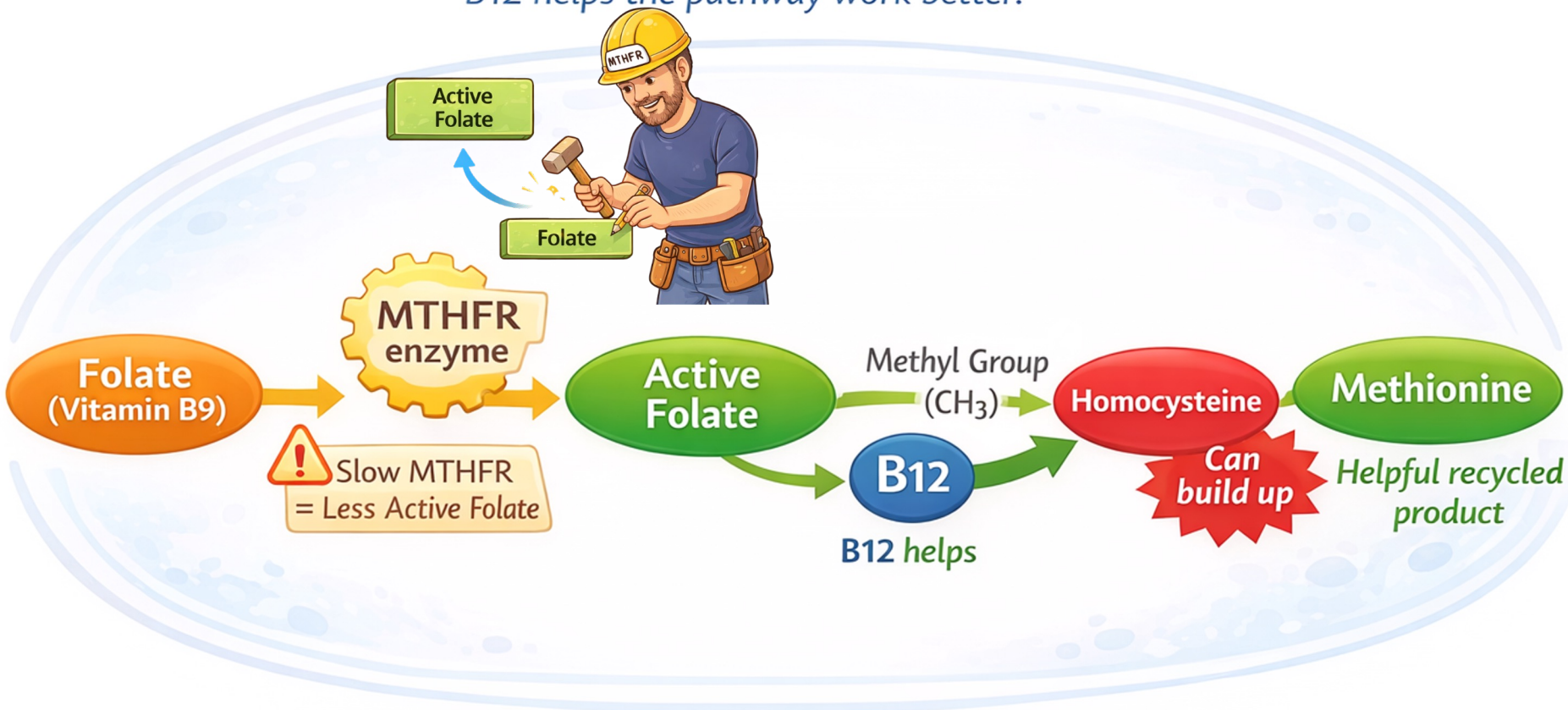
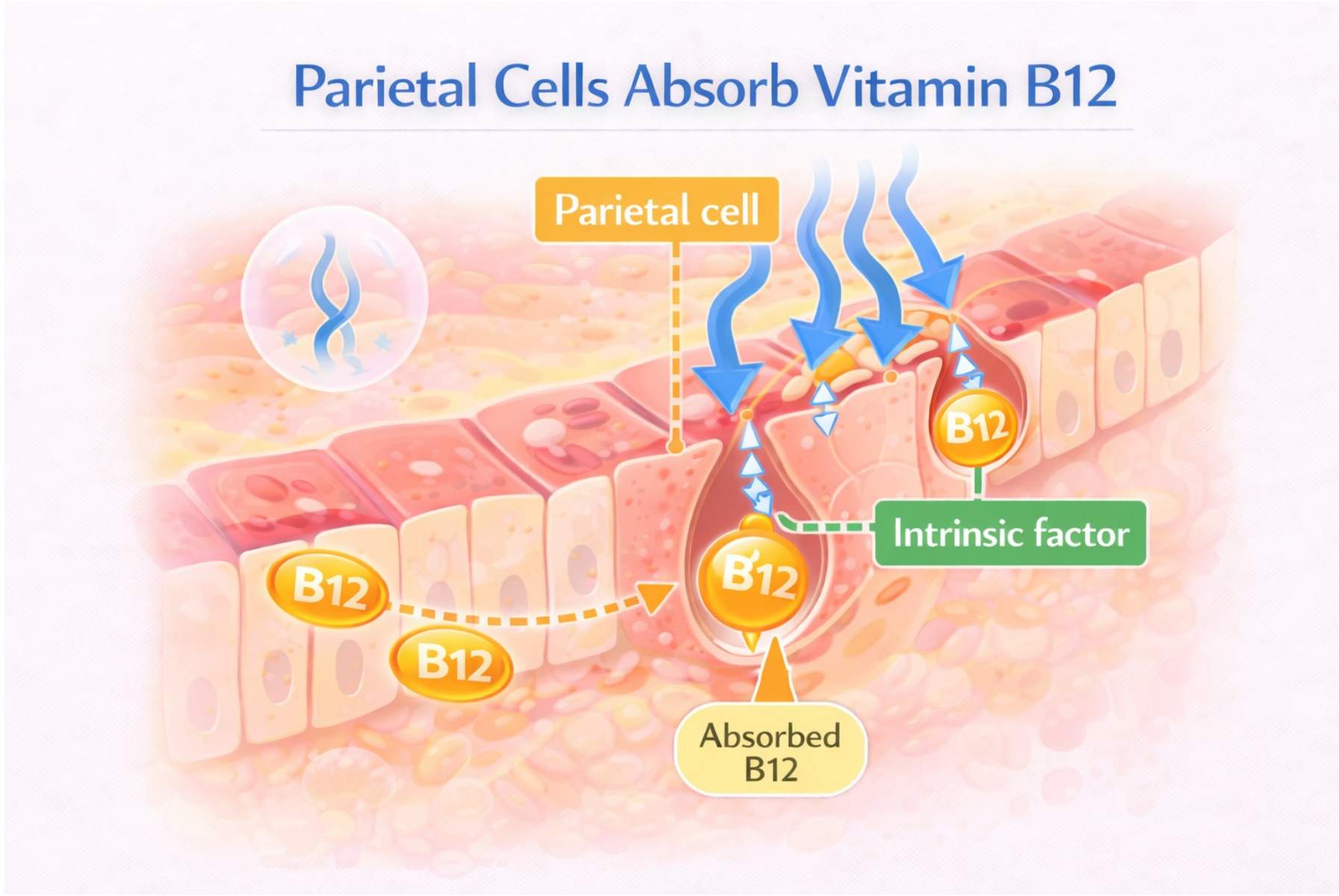


MTHFR *makes active folate.* **B12 *helps use it.***

- MTHFR makes active folate
- B12 helps active folate do its job
- Together they help lower homocysteine. MedlinePlus +1


Parietal Cells Absorb Vitamin B12
Parietal cell
B12
Intrinsic factor
B12
B12
B12
Absorbed
B12

Antiparietal Cell Antibody

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Rheumatoid Factor (RF)