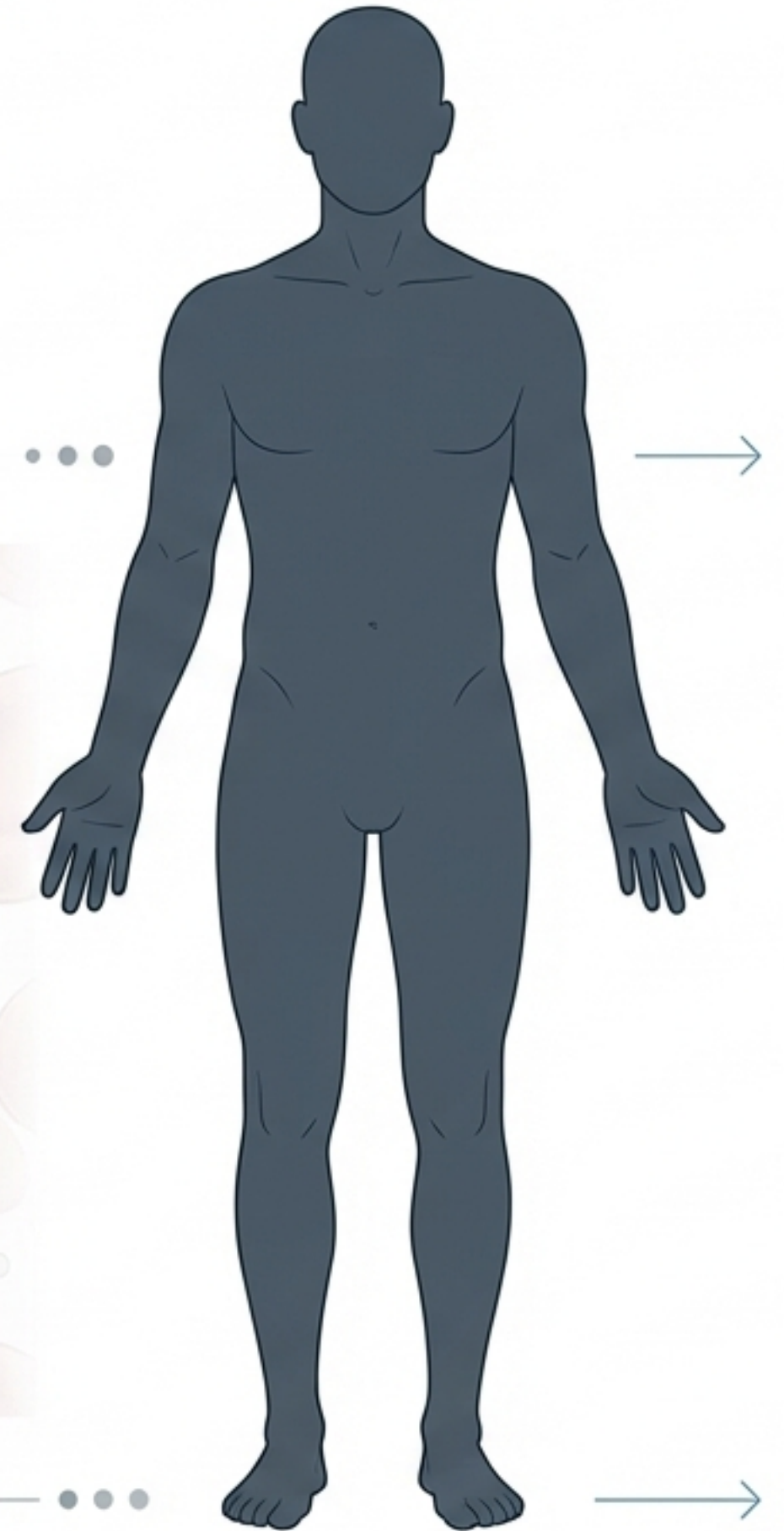
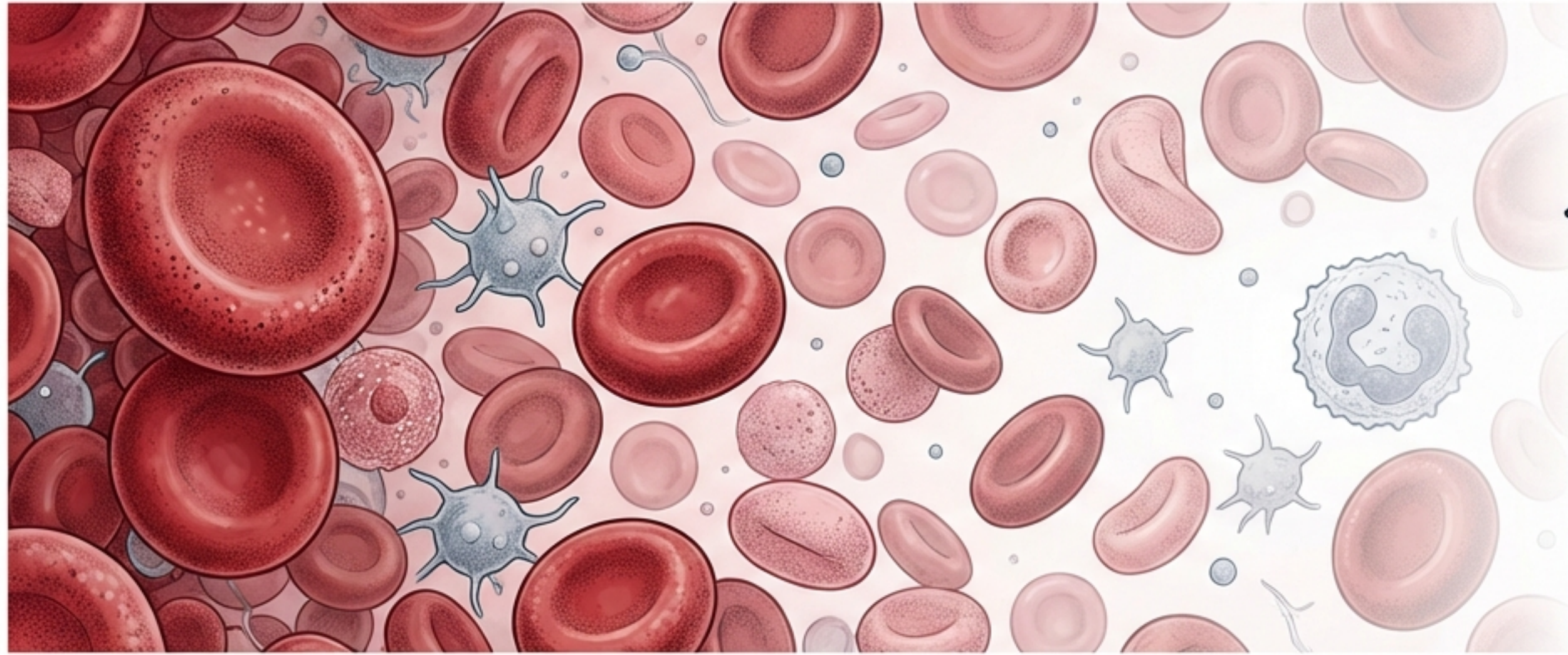


The Clinical Approach to the Patient with Anemia

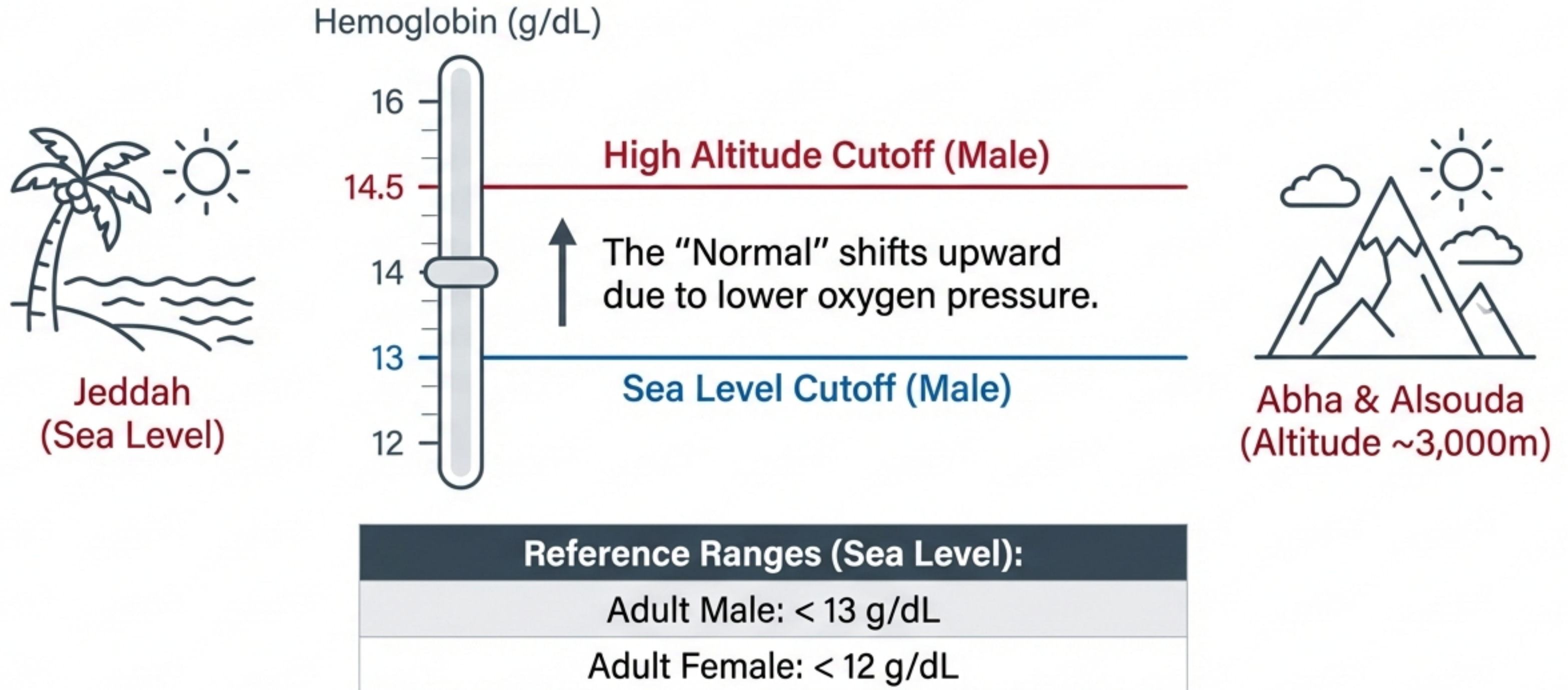
From Pathophysiology to Diagnosis: A Comprehensive Guide

Based on the work of Husain Alkhalidy, M.D.



Anemia is a Physiological State, Not Just a Number

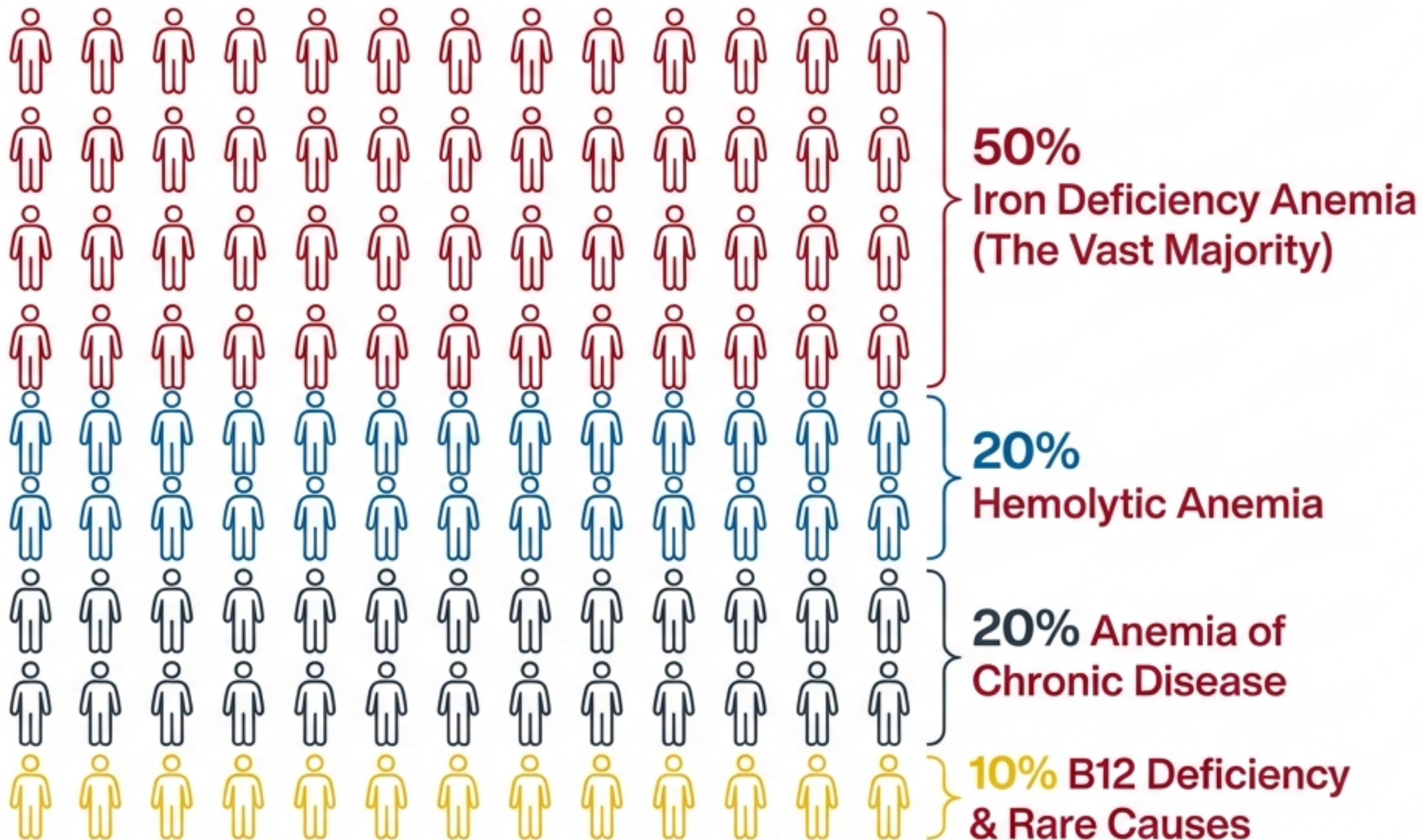
Definition: A state resulting from decreased tissue oxygenation due to low hemoglobin concentration.



Clinical Note: True definition depends on Age, Sex, Pregnancy, Altitude, and Smoking.

The Probability Game: Who is the Patient?

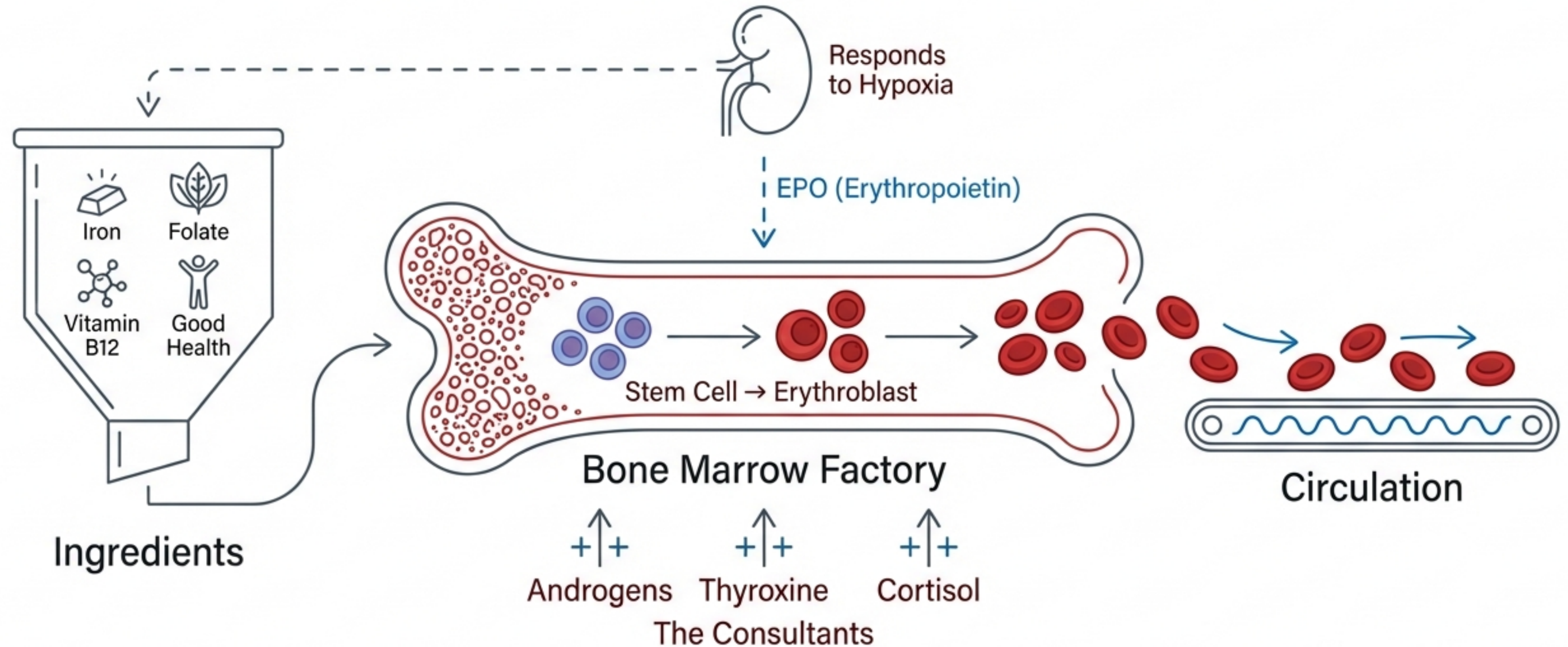
If 100 Patients with Anemia Walk into an Outpatient Clinic...



The Hospital Ward Flip

In an inpatient setting, the statistics reverse. The #1 cause becomes Anemia of Inflammation (Chronic Disease), followed by critical illness and blood extraction.

The Erythropoiesis Production Line

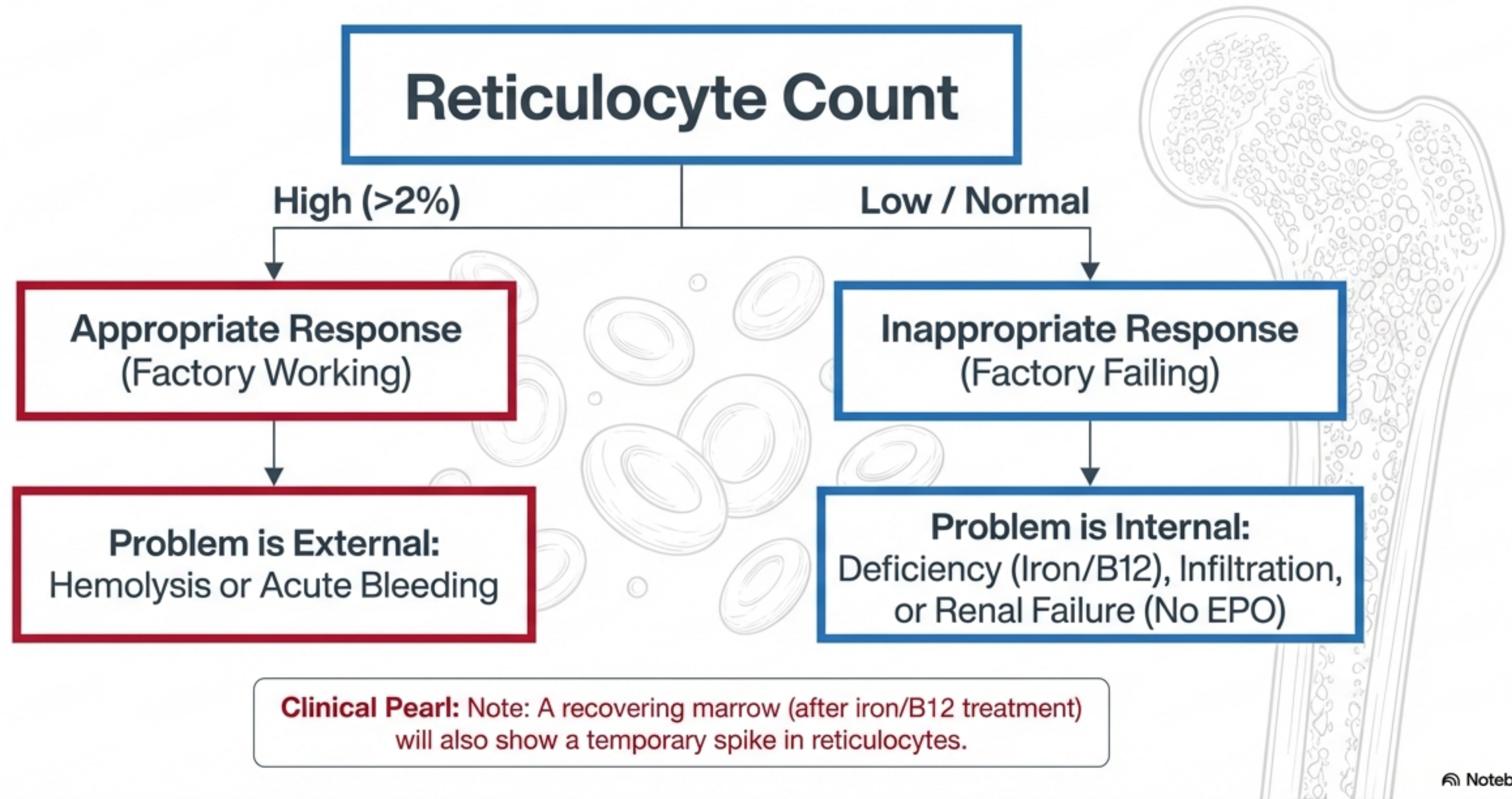


Factory Failure (Low Output):
Missing ingredients or broken machinery.

Product Loss (High Output):
Bleeding or Hemolysis.

Kinetic Classification: Is the Factory Responding?

Using Reticulocyte Count to assess bone marrow function.



Morphological Classification: Sizing the Problem



Microcytic (<80 fL)

- Iron Deficiency
- Thalassemia
- Anemia of Chronic Disease
- Sideroblastic



Normocytic (80–96 fL)

- Acute Blood Loss
- Renal Failure
- Early Chronic Disease
- Endocrine Disorders

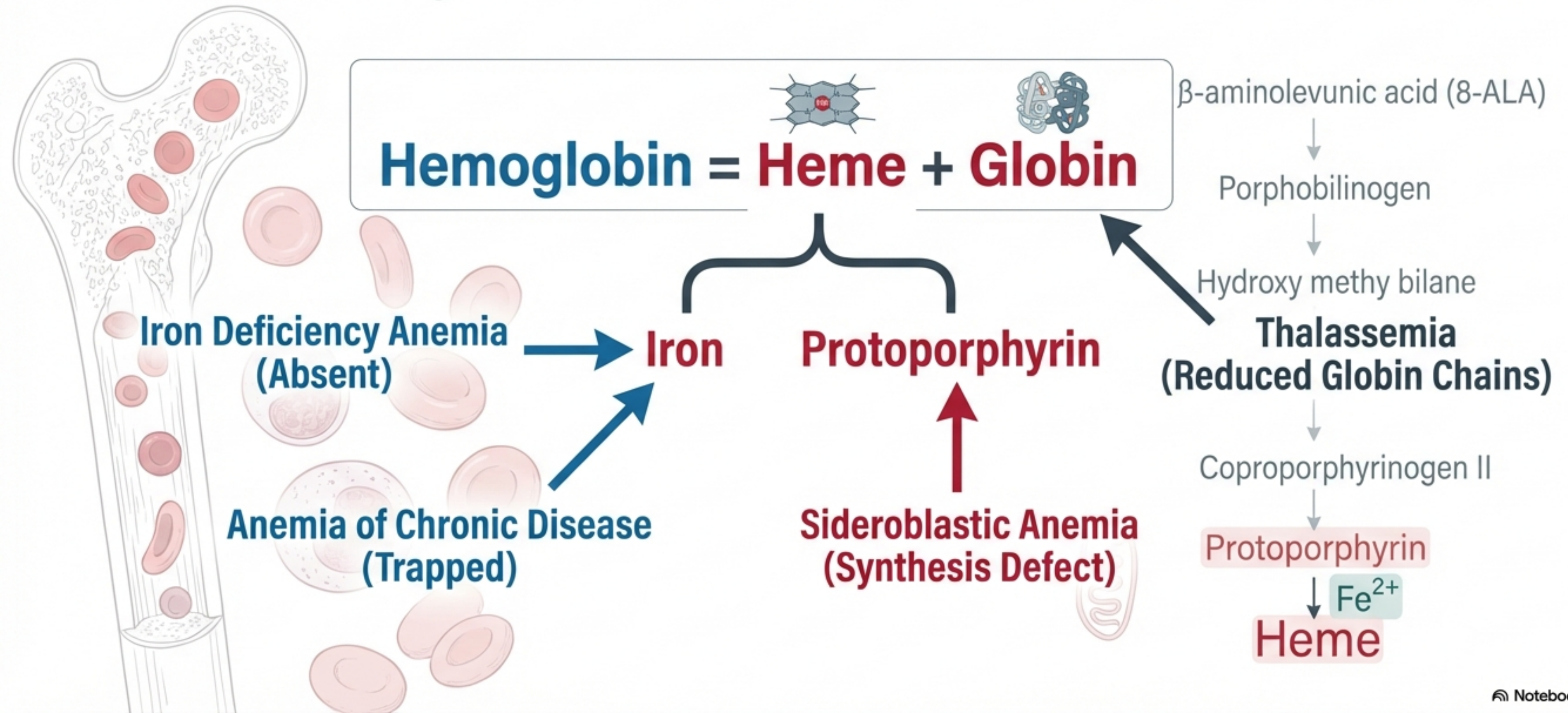


Macrocytic (>96 fL)

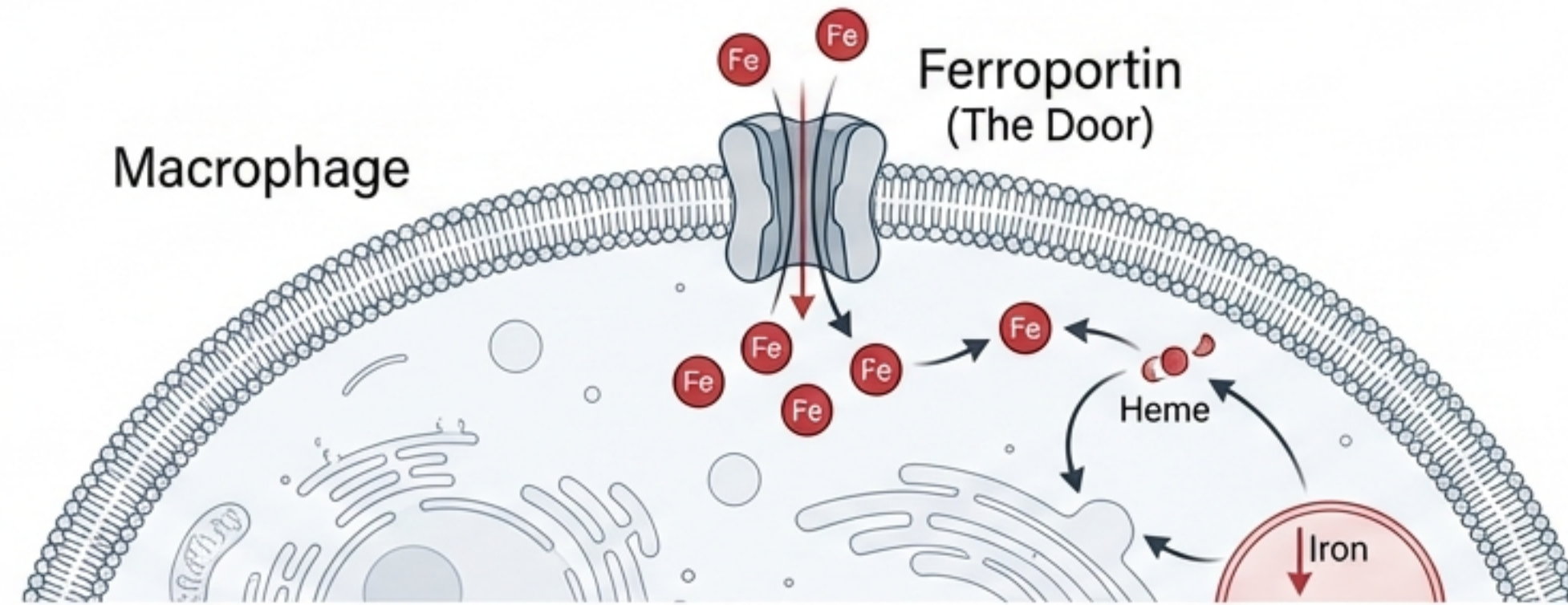
- Megaloblastic (B12/Folate)
- Non-Megaloblastic (Alcohol, Liver Disease)

Microcytic Anemia: The Case of the Shrinking Cell

Reduced Hemoglobin Production = Extra Cell Division = Smaller Cells

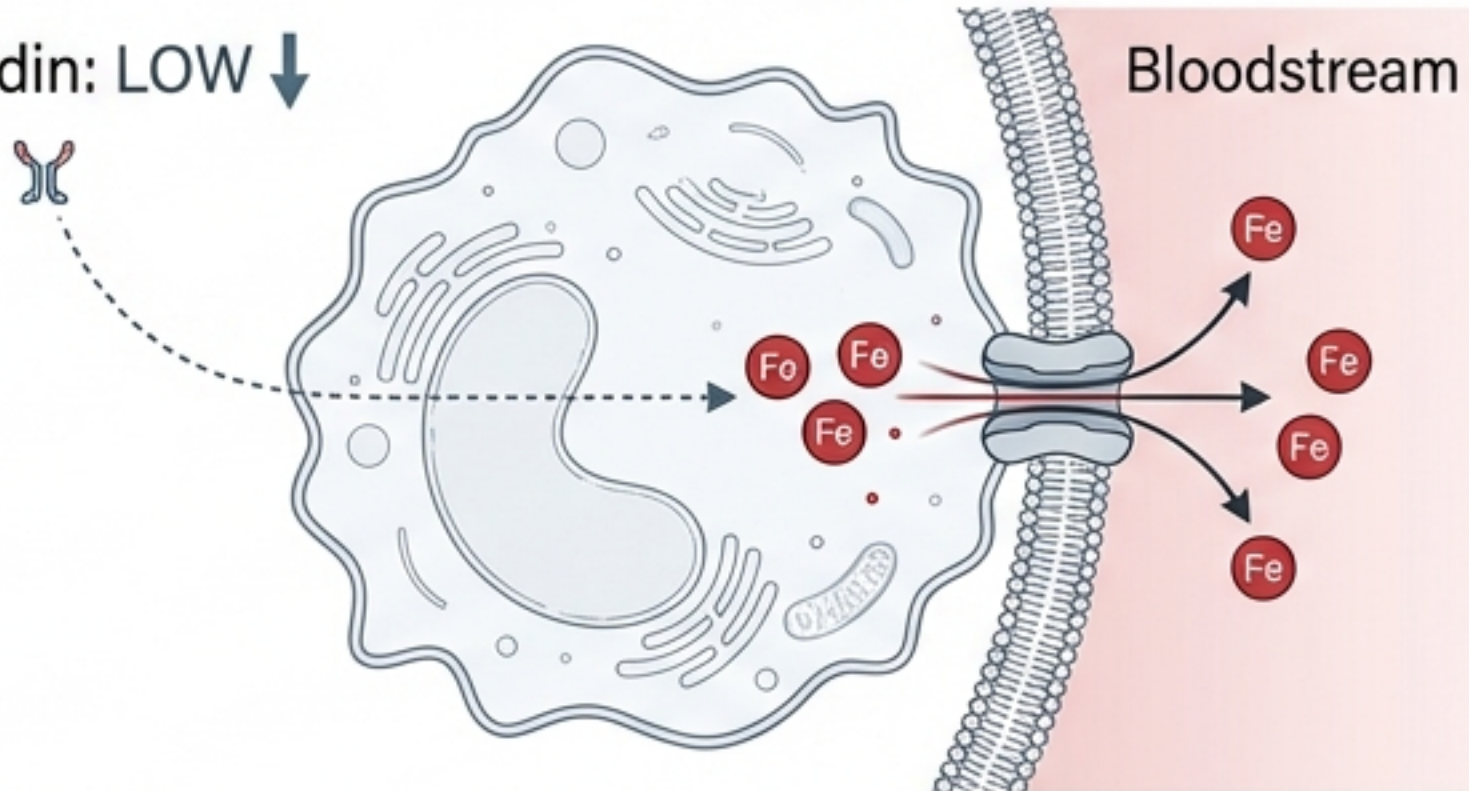


The Iron Gatekeeper: Hepcidin & Ferroportin



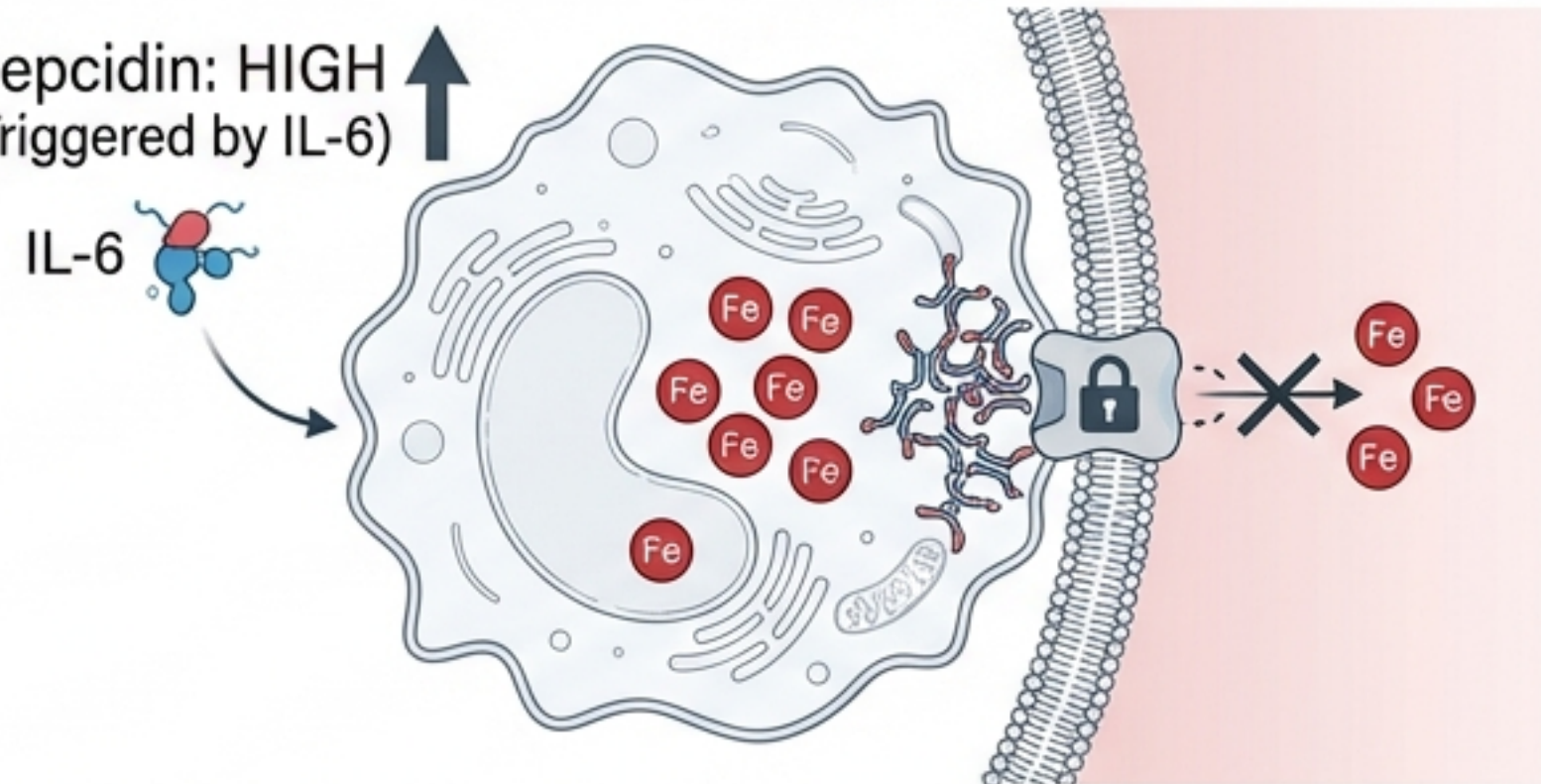
Scenario A: Iron Deficiency / High Demand

Hepcidin: LOW ↓



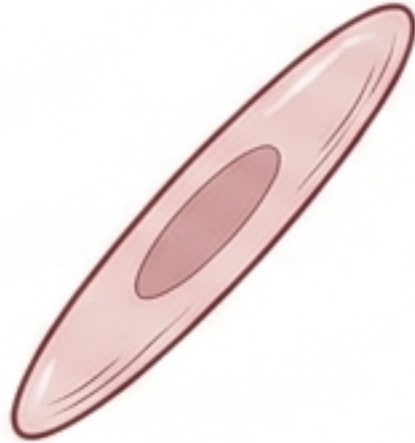
Scenario B: Inflammation (Chronic Disease)

Hepcidin: HIGH ↑
(Triggered by IL-6)



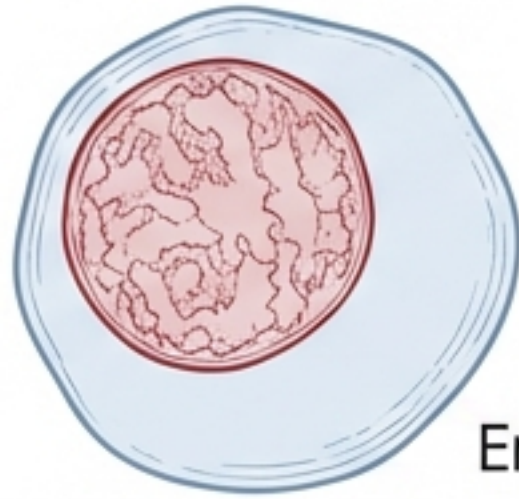
This mechanism explains why Ferritin (storage) is normal/high in chronic disease despite the patient being anemic.

Differentiating Microcytic Causes: IDA vs. Thalassemia

	Iron Deficiency Anemia (IDA)	Thalassemia Minor
Ferritin	Low (Diagnostic)	Normal or High
RDW	High (Varied cell sizes)	Normal (Uniformly small)
Smear	Pencil Cells, Anisocytosis  Pencil Cell	Prominent Target Cells  Target Cell
MCV	Proportional to anemia severity	Disproportionately low (e.g., MCV 60 with Hb 10)

Macrocytic Anemia: Nuclear Delays & Membrane Expansions

Megaloblastic (DNA Issue)



Erythroblast

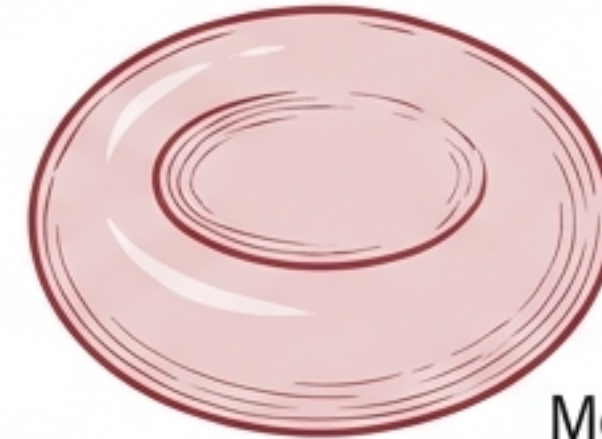
Mechanism: Nuclear-Cytoplasmic Dyssynchrony.
The cytoplasm grows, but the nucleus lags.

Causes: B12 Deficiency, Folate Deficiency, Drugs.



Hypersegmented
Neutrophil

Non-Megaloblastic (Membrane Issue)

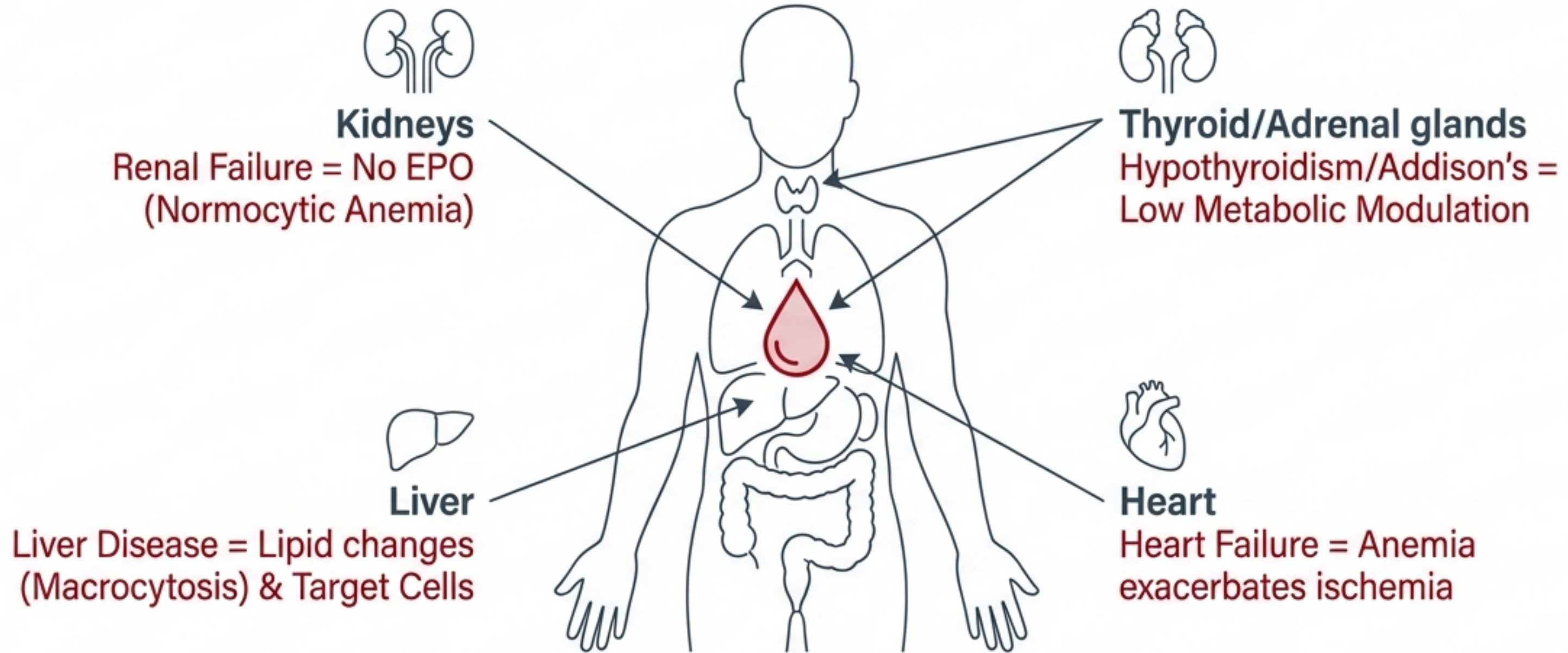


Membrane

Mechanism: Lipid deposition increases membrane surface area.

Causes: Alcoholism, Liver Disease, Hypothyroidism

Systemic Associations: The 'Why' Behind the Anemia

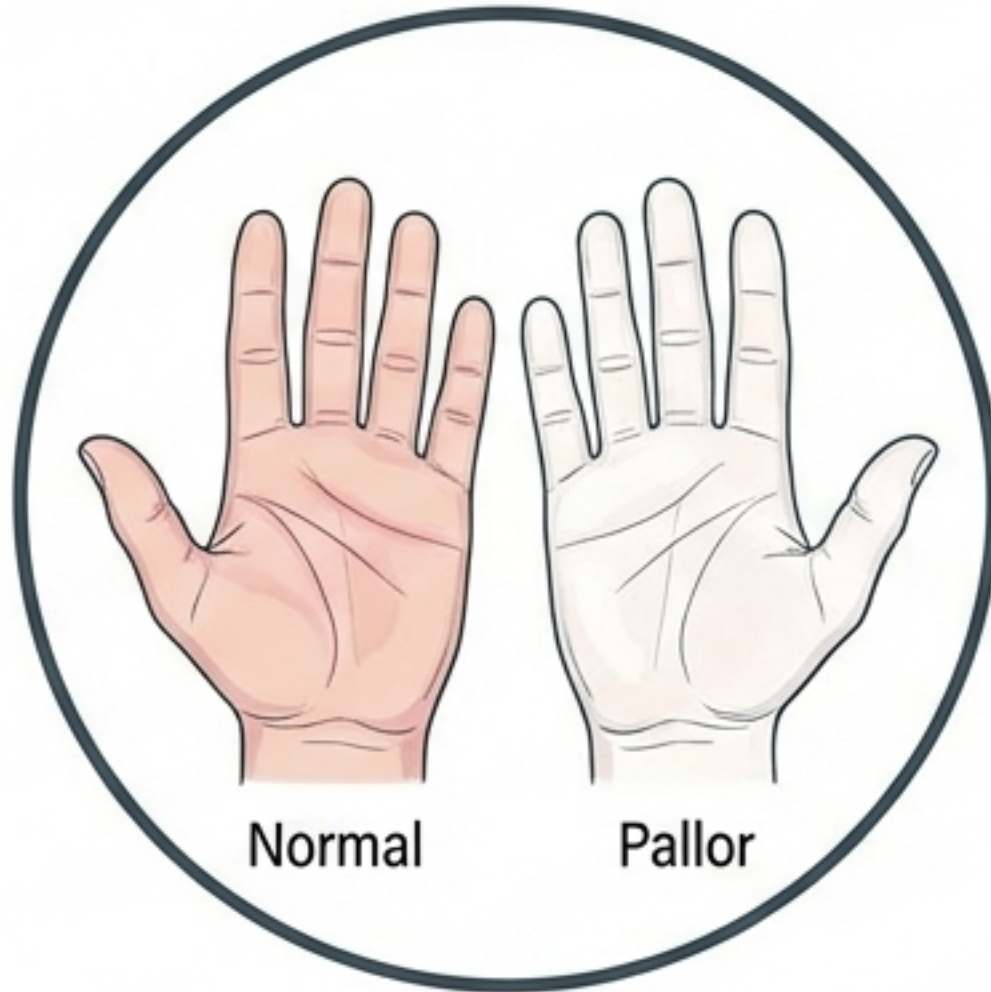


CRITICAL ALERT: Pancytopenia

If Hb + WBC + Platelets are ALL low, suspect Bone Marrow Failure (Aplastic) or Leukemia. Immediate referral.

Reading the Body: Physical Signs of Anemia

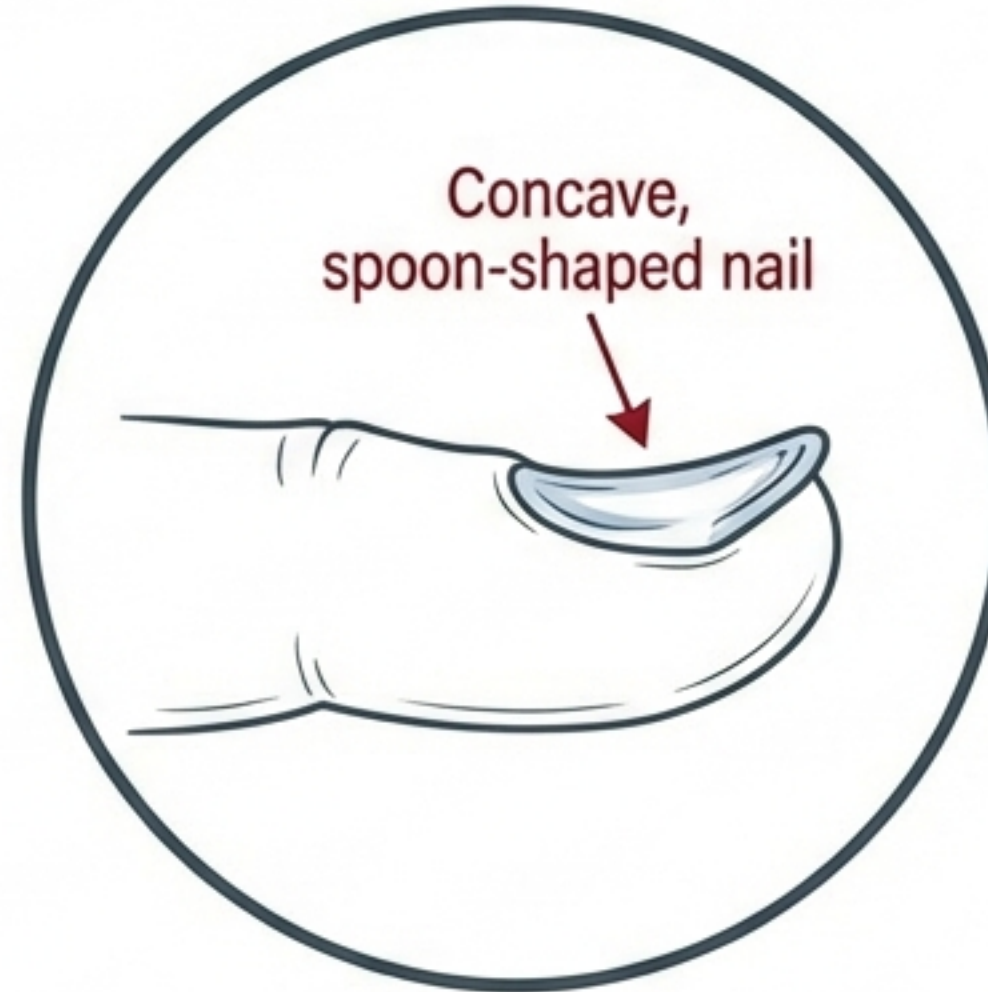
Pallor



Pallor

Pale coloration, particularly in creases and mucous membranes.

Koilonychia



Koilonychia

Specific to prolonged Iron Deficiency.

Glossitis



Glossitis

Inflammation and smoothness due to papillae atrophy.

Case Study 1: The Revolving Door of Iron Deficiency



**Lesson: Iron replacement is temporary.
You must treat the source of the blood loss.**

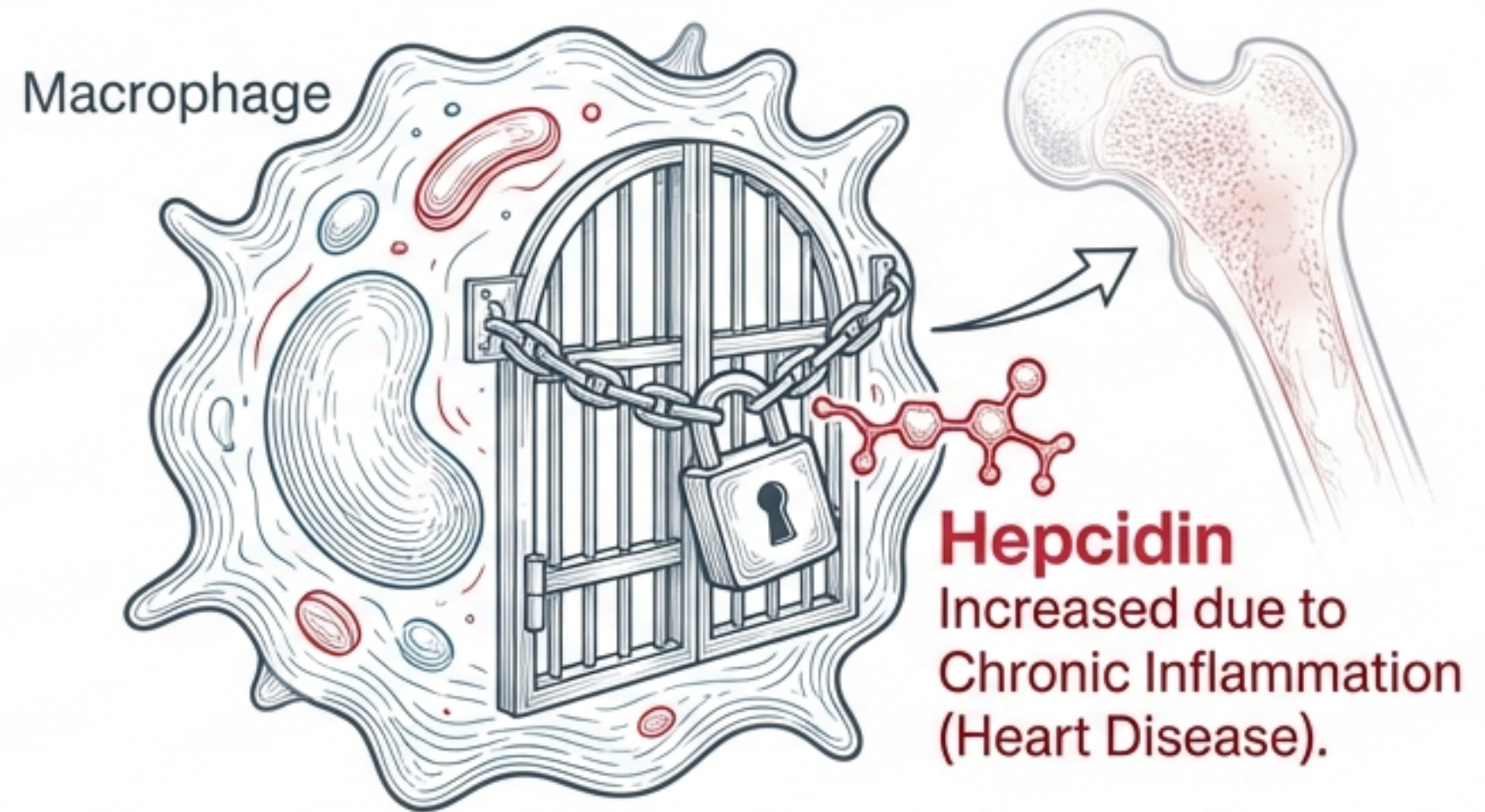
Case Study 2: The Trap of Normal Ferritin

Patient Profile

45yo Female, Rheumatic Heart Disease.

Lab Results: Hb 9.9 (Low),
MCV 78 (Microcytic),
Ferritin NORMAL.

The Explanation Diagram



Diagnosis: Anemia of Inflammation.

Iron is trapped in stores, making Ferritin normal/high, but the bone marrow is starved of iron.

Summary: The CBC is the Physical Exam of the Blood

1

Context Matters.

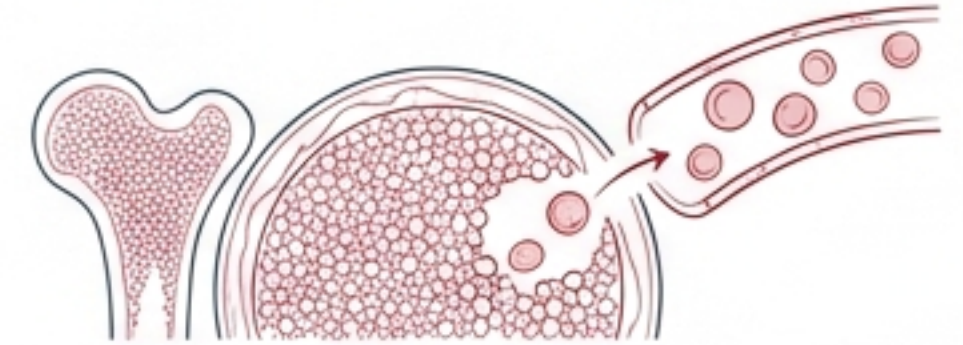
Adjust "Normal" for Altitude, Age, and Pregnancy.



2

Check the Factory (Kinetic).

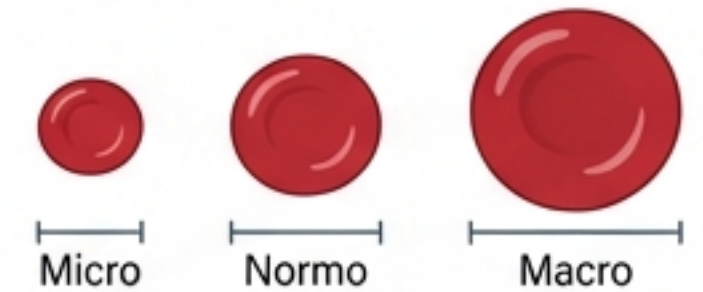
Use Reticulocytes to differentiate Failure vs. Loss.



3

Check the Size (Morphologic).

Use MCV to narrow the differential (Micro/Normo/Macro).



4

Treat the Patient.

Don't just fix the number. Find the bleeding, the deficiency, or the disease.



"Formulate a differential, confirm with labs, and treat the underlying cause."