

GREEN FACTORY KITE AS A NATURAL
SUBSTITUTE TO **“HEME”**

GREEN FACTORY KITE: PORPHYRIN (TETRAPYRROLE) RING

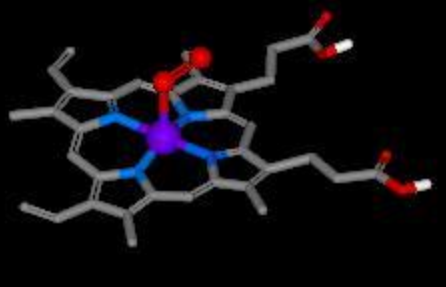
1. HEME
2. CHLOROPHYLL
3. CHLOROPHYLLIN
4. PHEOPHYTIN

GREEN FACTORY KITE : PORPHYRIN RING

Porphyryns are a group of heterocyclic macrocycle organic compounds, composed of four modified pyrrole subunits interconnected at their α carbon atoms via methine bridges ($=CH-$). The parent porphyrin is porphin and substituted porphines are called porphyrins



Many Porphyryns are naturally occurring; one of the best-known Porphyryns is Heme and Chlorophyll .

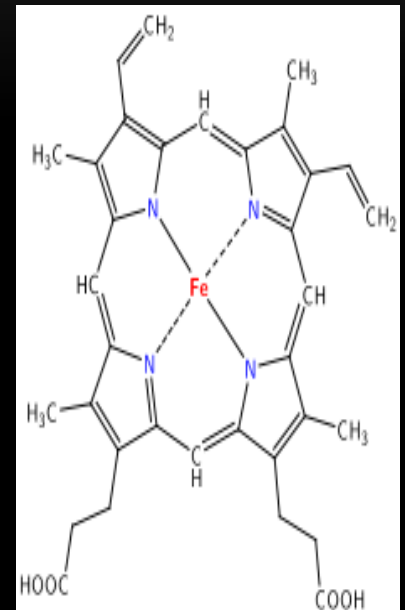


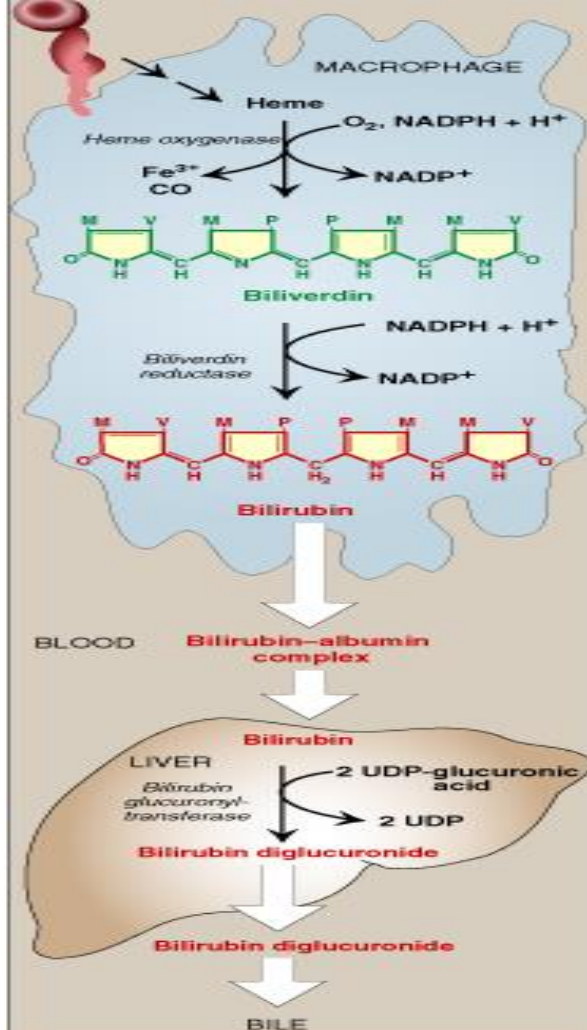
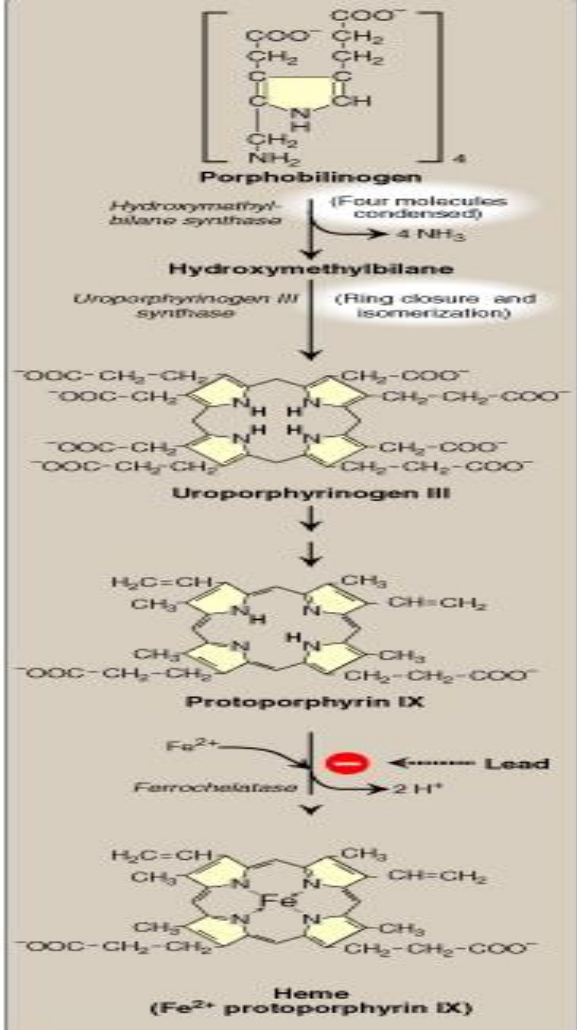
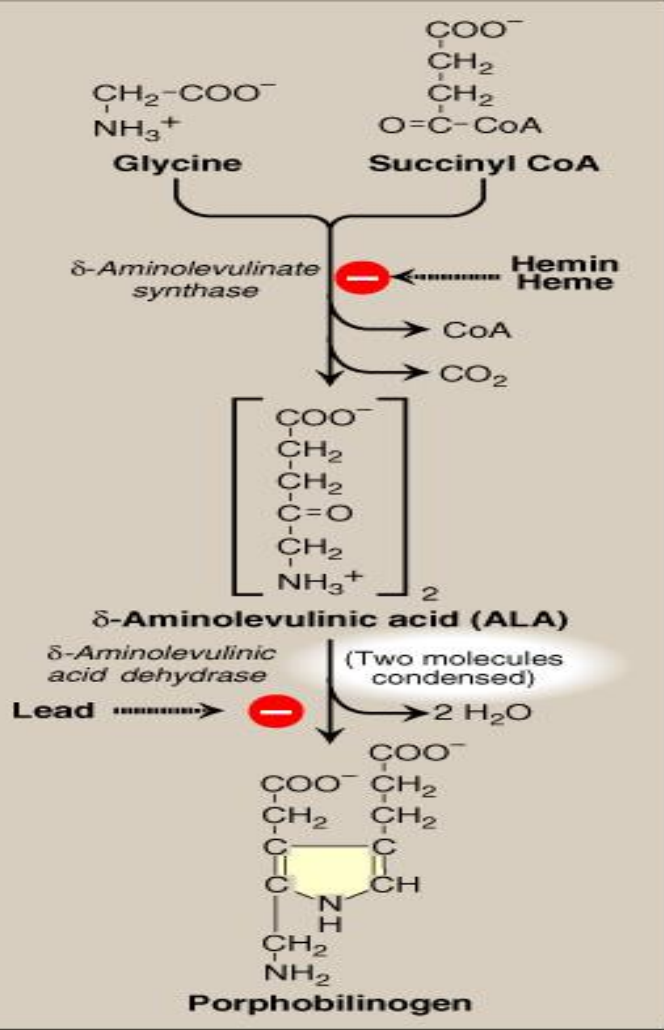
HEME

Hemoglobin has a structure in which the porphyrin part called ‘**HEME**’ is connected to a big protein . Positioned at the center of this heme is an iron atom, and a molecule of oxygen attaches to it as an axial ligand. An oxygen molecule is not a strong metal-binder naturally, so it usually doesn’t form a stable complex with metal ions. But porphyrin makes it happen, showing its unique ability.

Carrier of Oxygen

Hemoglobins are designed to capture oxygen molecules actively in the places where there is an abundance of O_2 , and to release them when there is a shortage. A liter of human blood is said to have the capacity of carrying the same amount of oxygen contained in a liter of air, which tells you about the efficiency of the chemistry.





Synthesis of Heme

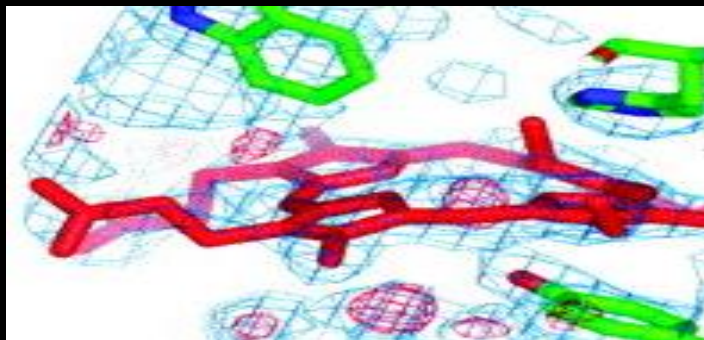
Heme : Iron Insertion

Metal insertion in porphyrins is performed by a class of complexes called “Chelatases”

Ferrochelatase

To force iron (II) into the heme ring, Ferrochelatase holds the ring in a bent conformation

This bending causes the ring to pop out of the enzyme once iron insertion is complete

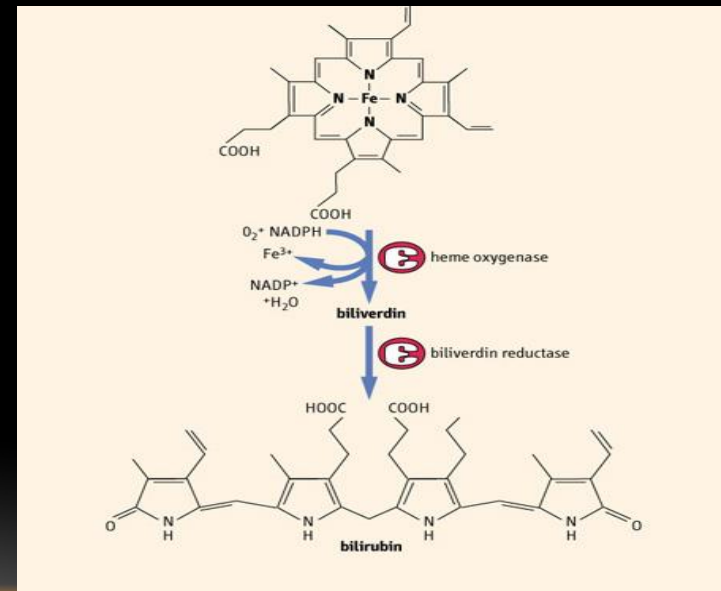


Heme: Breakdown

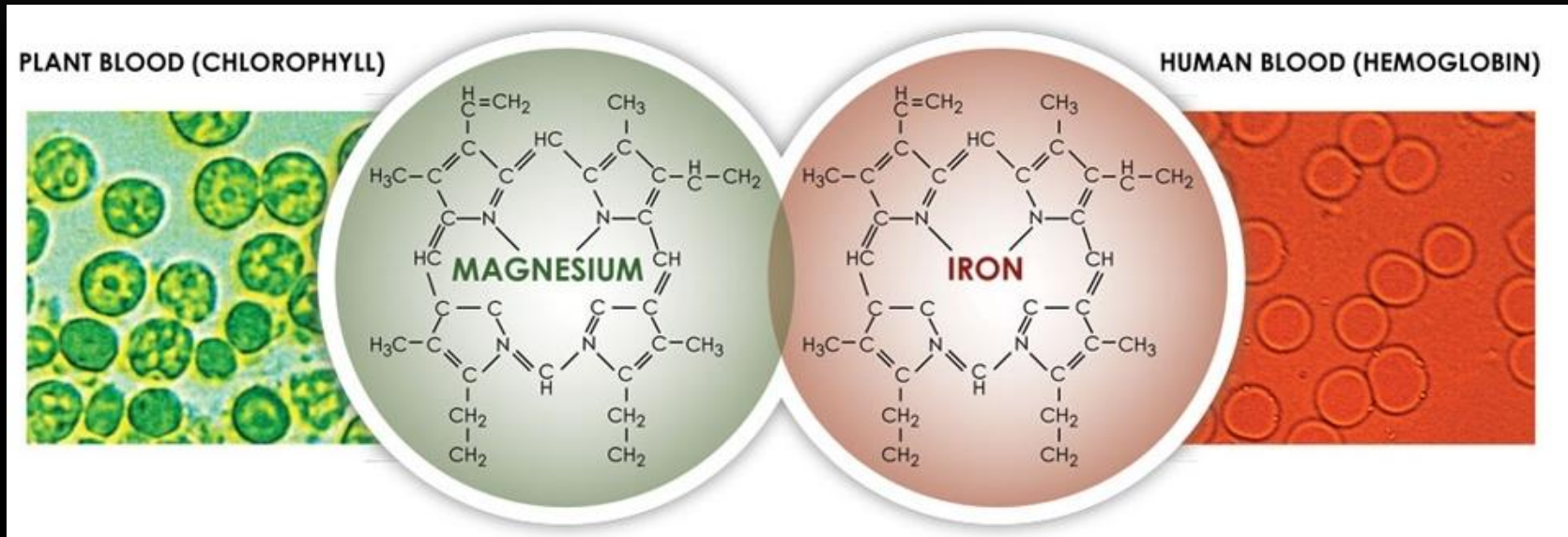
Recycling the iron in heme is critical for survival

To make sure iron is not unnecessarily wasted, a complex system for recycling the iron in heme is employed.

The ring itself is solubilized and eliminated, only the metal is reused

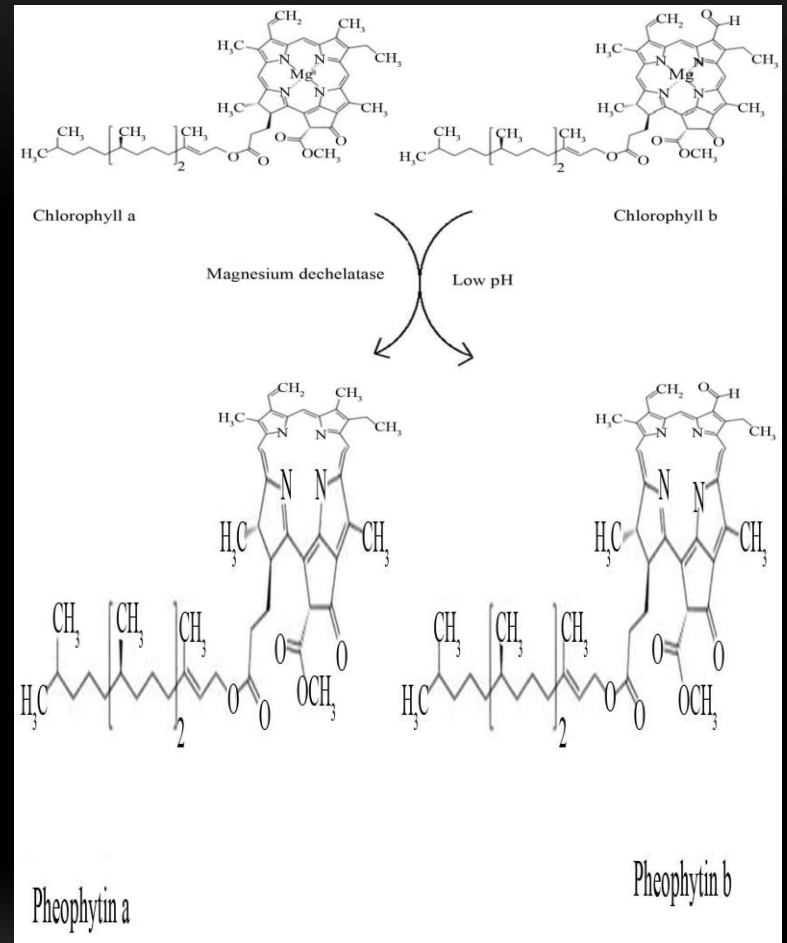
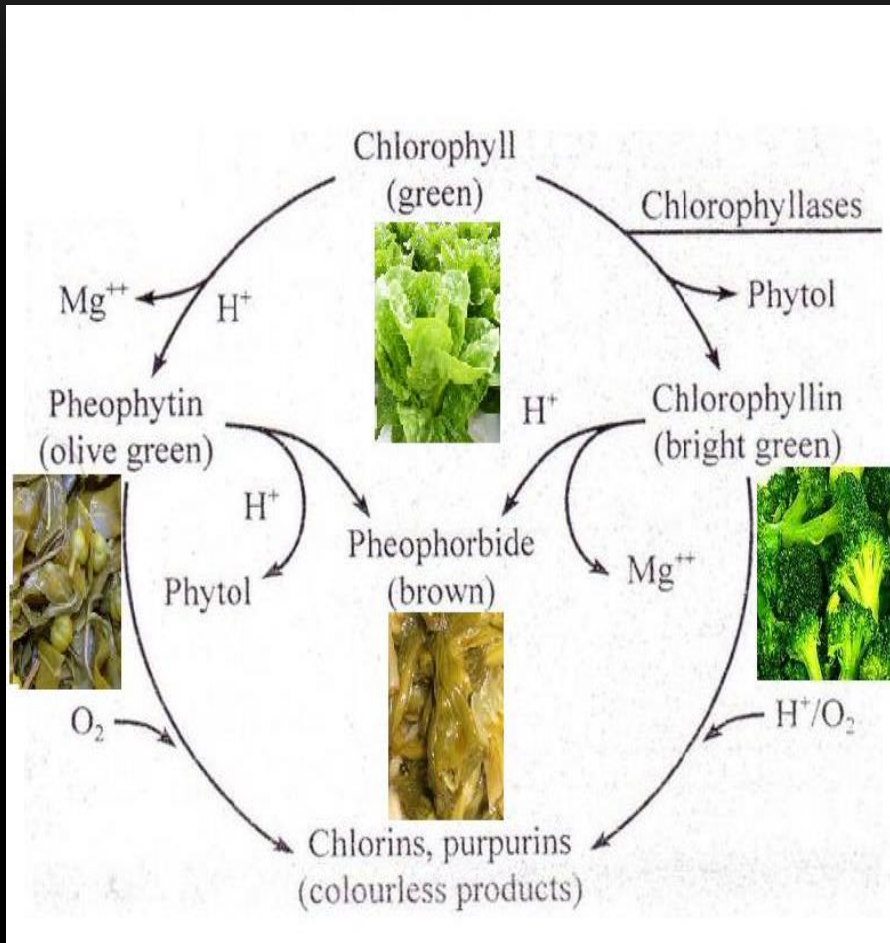


HEME & CHLOROPHYLL-: STRUCTURALLY SIMILAR



The molecular structure of chlorophyll is virtually identical to hemoglobin. The major difference between chlorophyll and hemoglobin is the central metal atom. In hemoglobin the central atom is Iron (Fe), and in chlorophyll it is Magnesium (Mg).

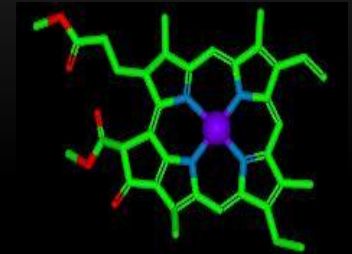
CHLOROPHYLL DERIVATIVES



CHLOROPHYLL : A STRUCTURAL ANALOGUE TO HEME

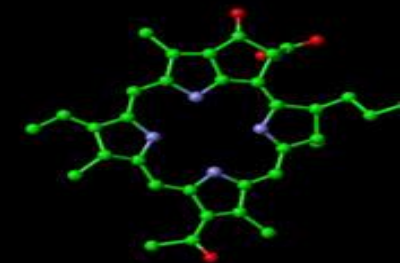
Chlorophyll

- Chlorophyll a and chlorophyll b are natural, fat-soluble chlorophylls found in plants.
- The basic structure of chlorophyll is a porphyrin ring similar to that of heme in hemoglobin, although the central atom in chlorophyll is magnesium instead of iron. The long hydrocarbon (phytol) tail attached to the porphyrin ring makes chlorophyll fat-soluble and insoluble in water.



Chlorophyllin.

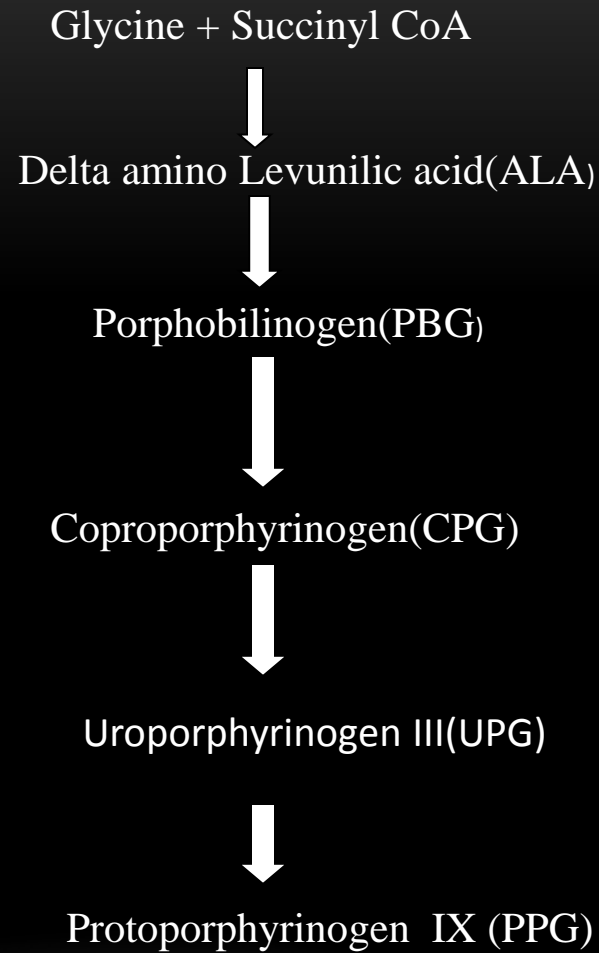
- Chlorophyllin is a semi-synthetic mixture of sodium copper salts derived from chlorophyll. During the synthesis of chlorophyllin, the magnesium atom at the center of the ring is replaced with copper and the phytol tail is lost.
- Chlorophyllin is water-soluble.

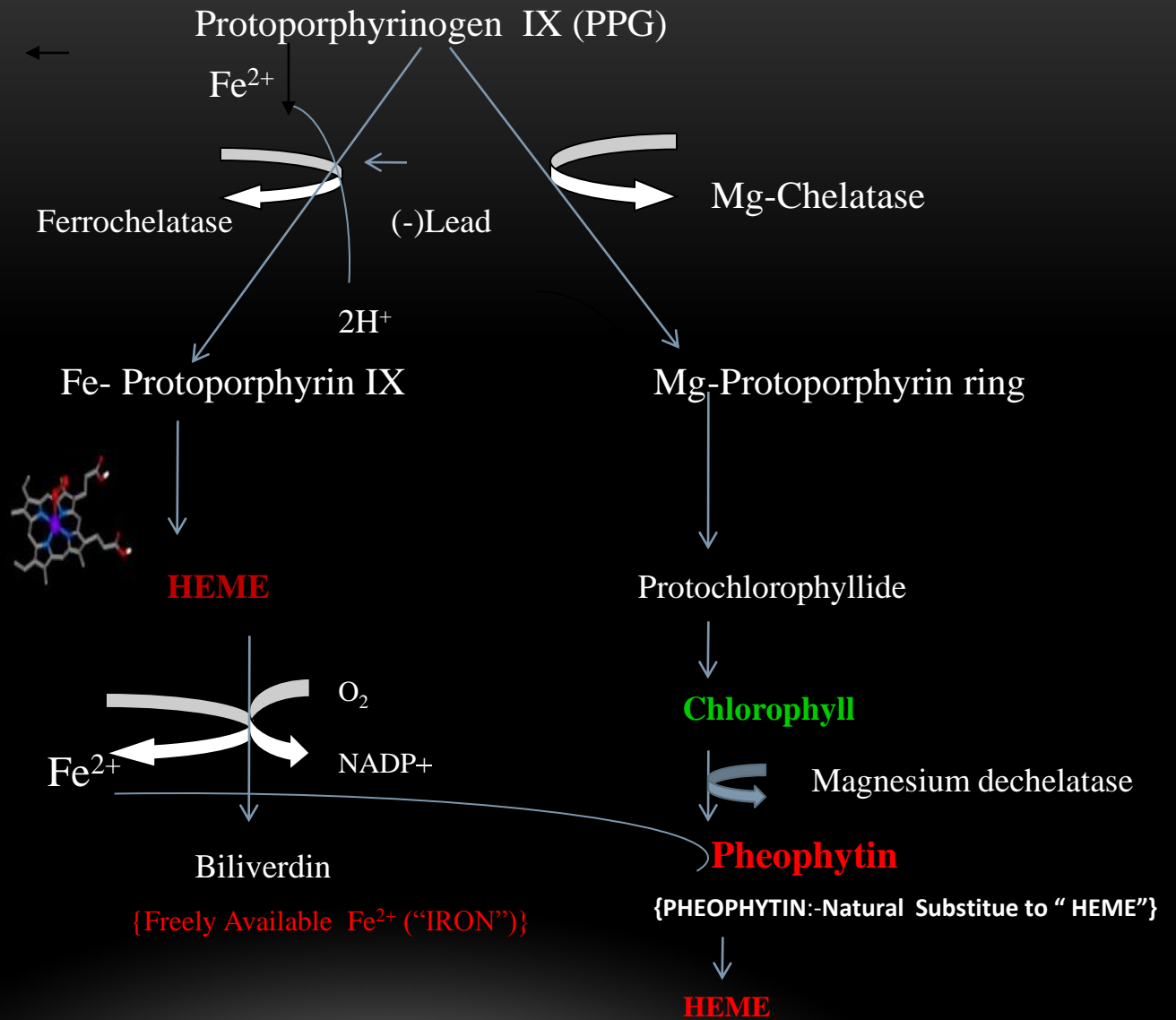


Pheophytin

It is a derivative of chlorophyll without centered metal ion. It displaces the magnesium ion found at the heart of chlorophyll.

PORPHYRIN (Tetrapyrroles) –AS A NATURAL SUBSTITUTE TO “HEME”





CONCLUSION

The structural homology of chlorophyll with hemoglobin indicates the role of chlorophyll as a blood builder in various clinical conditions involving hemoglobin deficiency.

Thus the name “Porphyrin Ring“ seems to be very promising and extensive research work is needed in order to explore its therapeutic application.

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THANK YOU