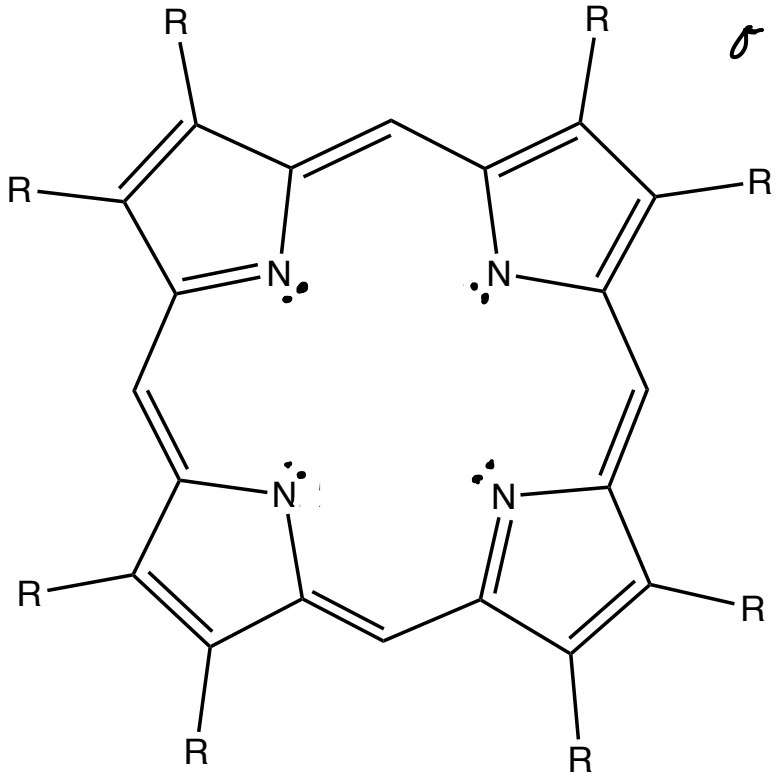
(35) **Today**

Hemoglobin

The Final is Scheduled for Wednesday, December 20 from 10:10 to 12:10

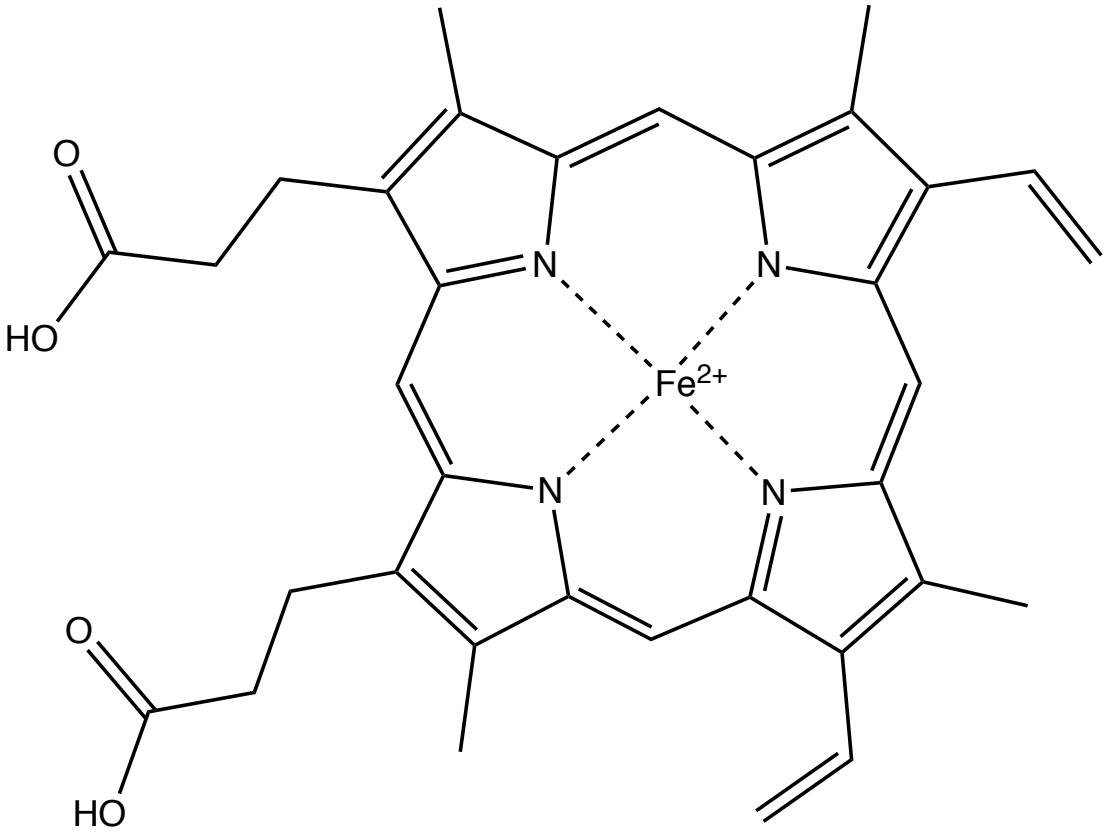
Porphyrins



σ donor N atoms

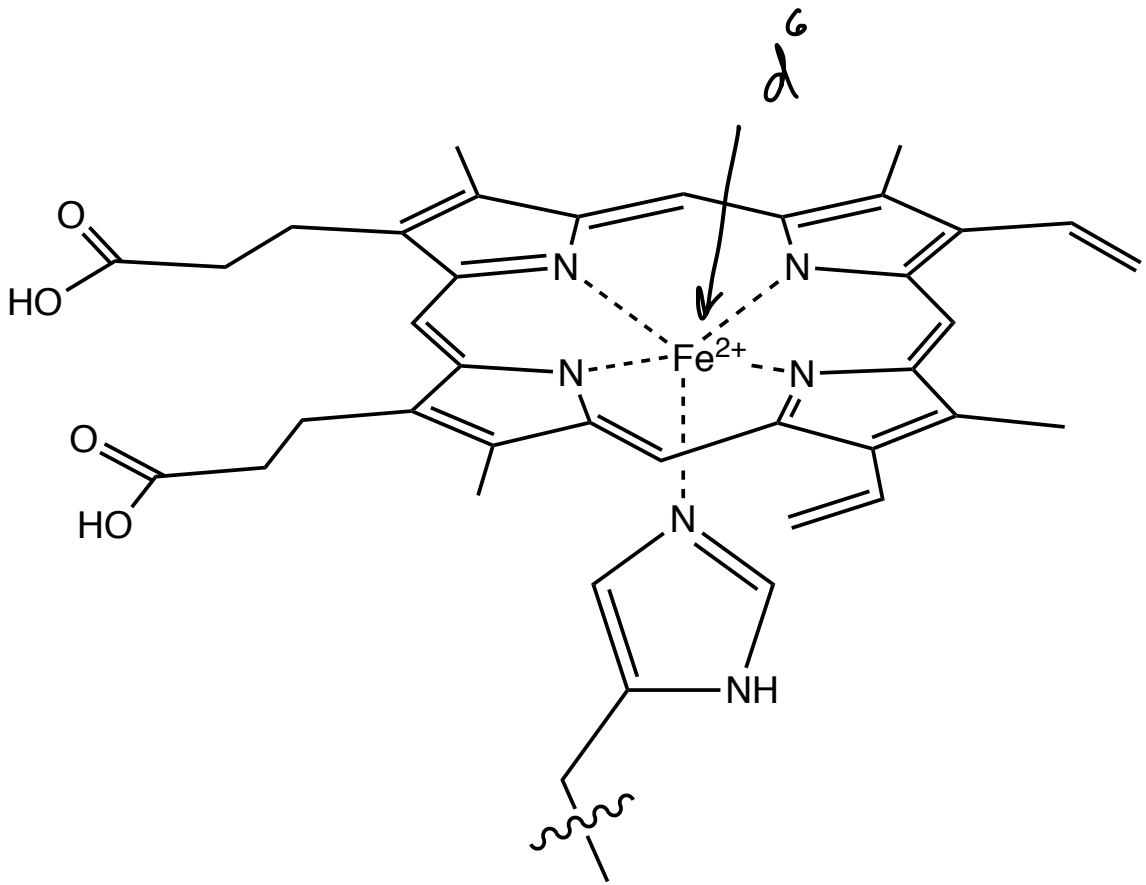
weak π acceptor ligand due to π antibonding orbitals

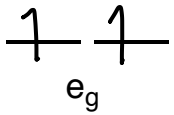
Heme



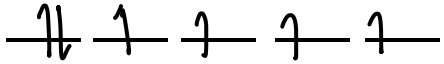
Fe is not coplanar with the ring

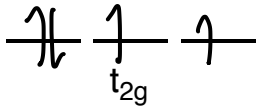
Hemoglobin



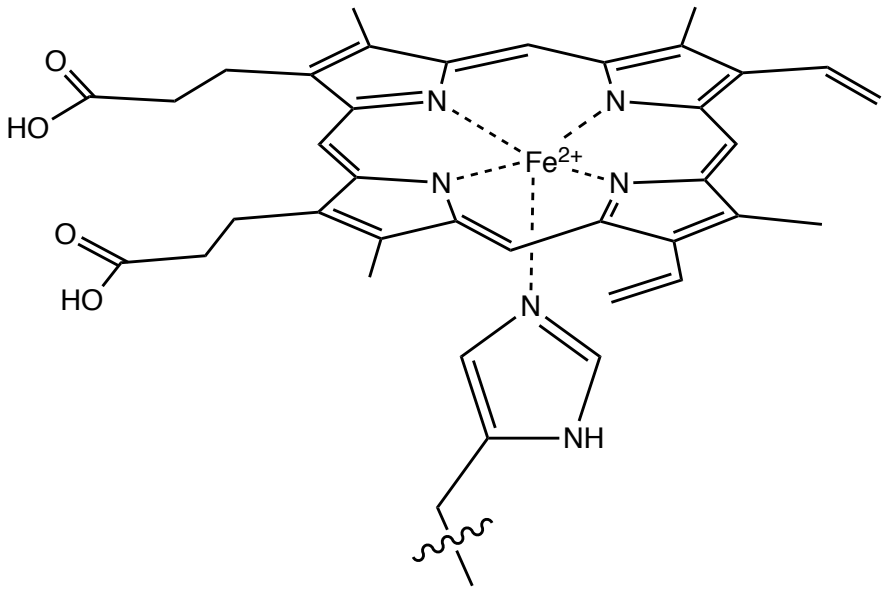


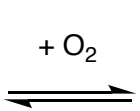
high spin

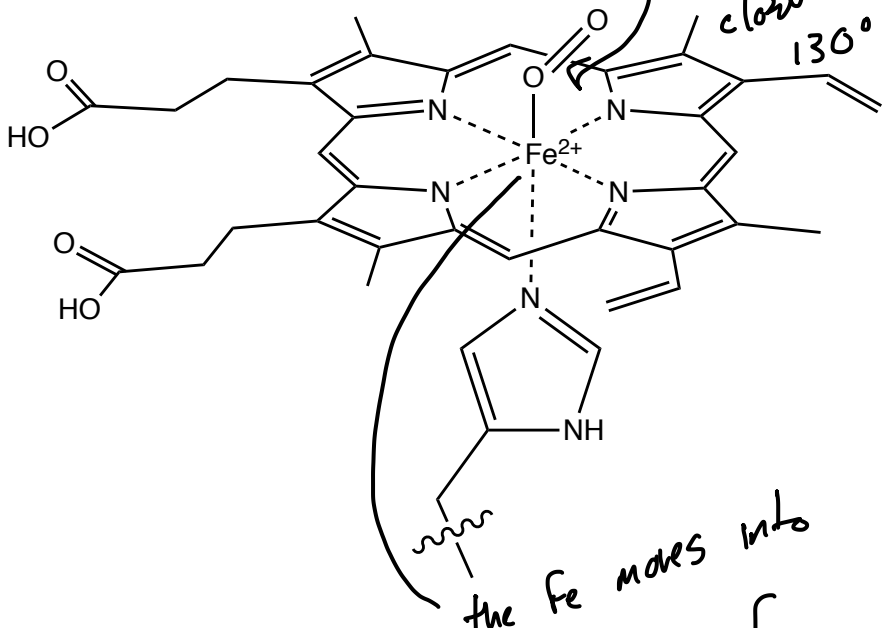




O_2 Binding





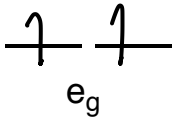


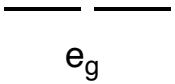
O_2 is a σ donor and a π acceptor

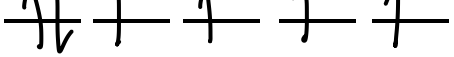
not 180° closer to 130°

the Fe moves into the plane of the porphyrin when it binds O_2 ...

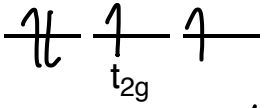
changes the shape of the protein and makes other Heme's more capable of binding O_2



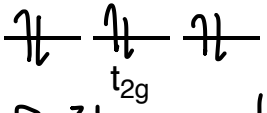




Fe^{2+}



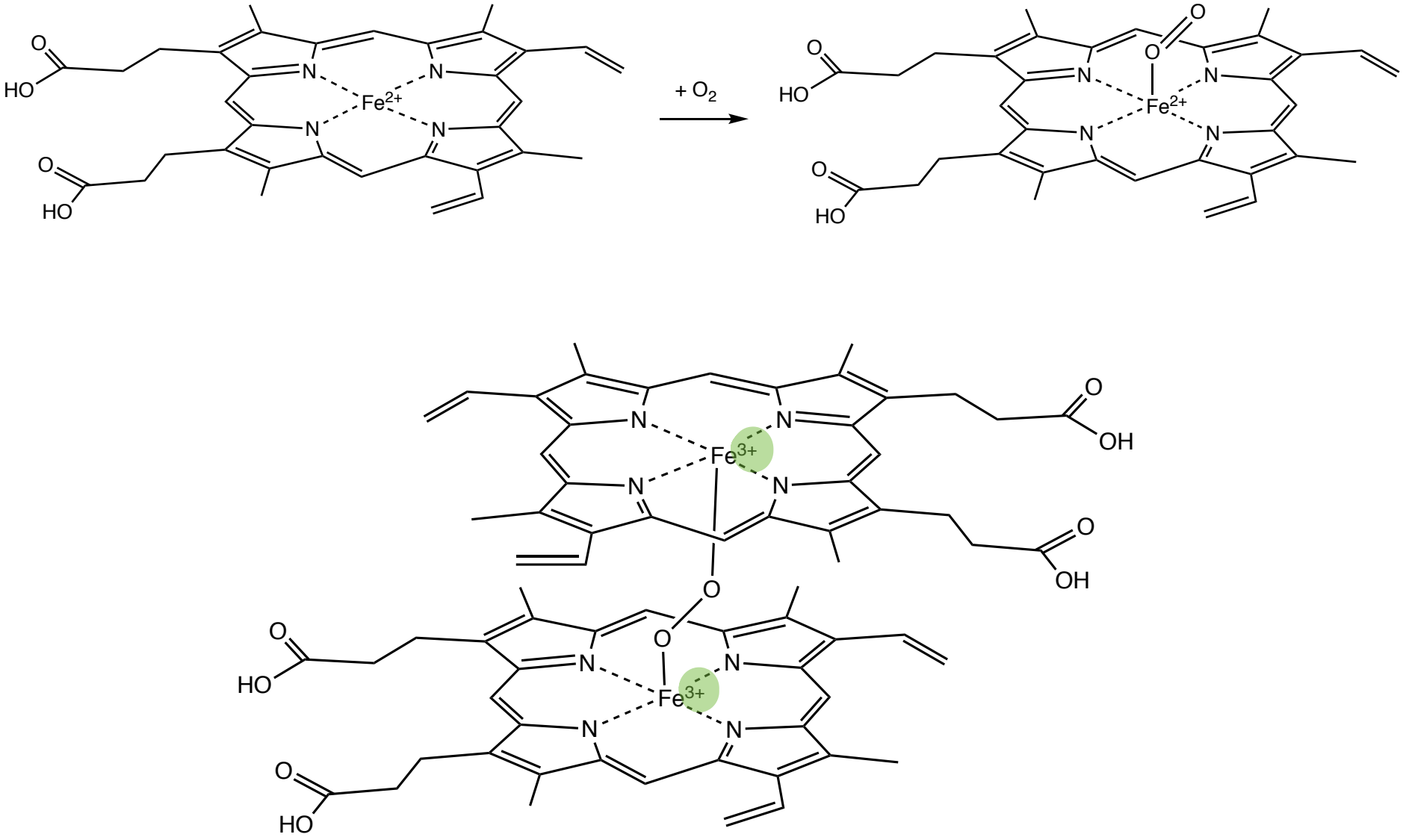
Fe^{2+} in octahedral field



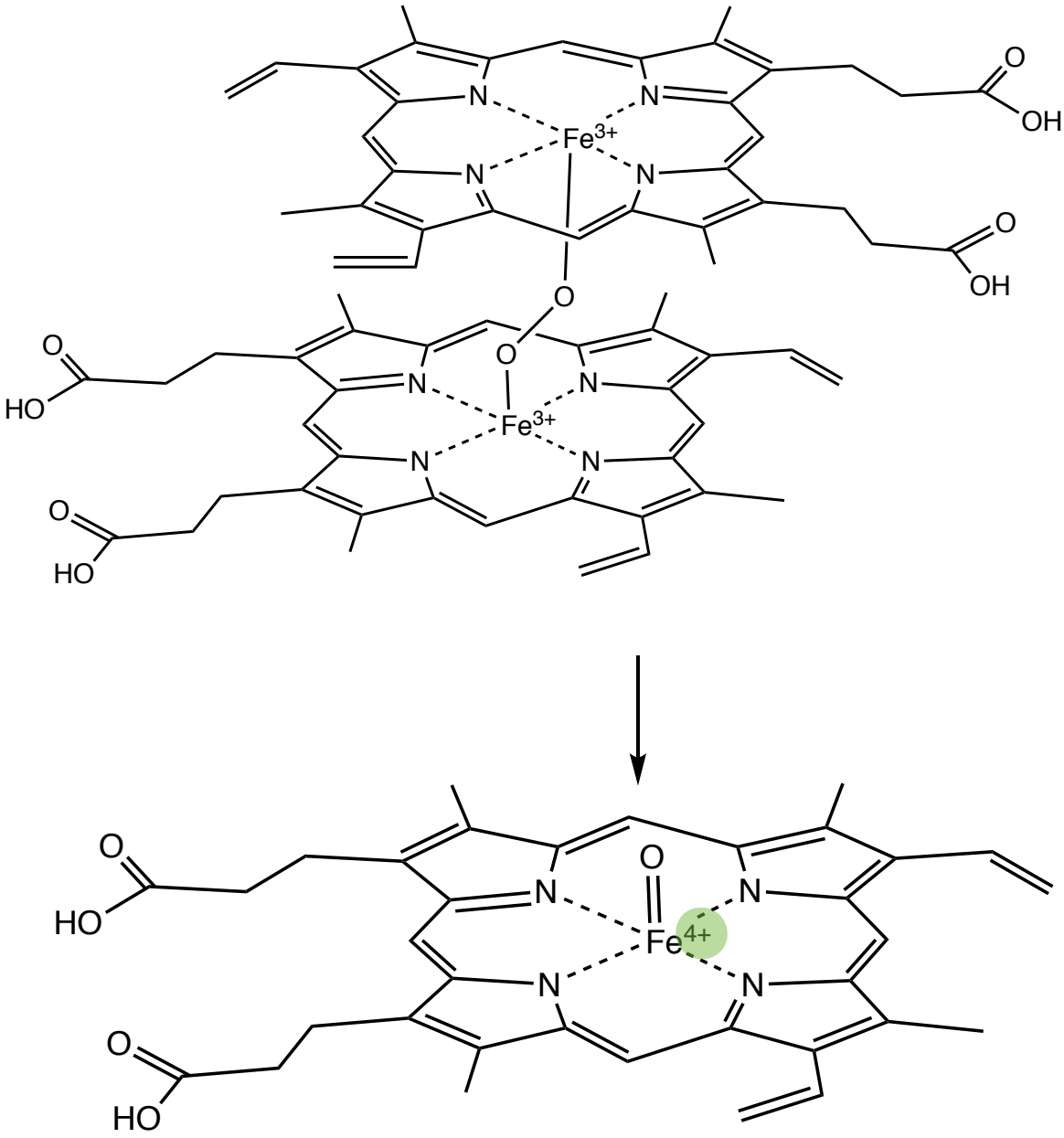
Fe^{2+} in octahedral Field with O_2

simplified models for d orbital splitting in heme

Free Heme


HO
O
HO
O
N
N
N
N
Fe2+
+ O2
HO
O
HO
O
O
N
N
N
N
Fe2+
N
N
N
N
Fe3+
OH
O
OH
O
O
O
HO
O
HO
O
N
N
N
N
Fe3+

Free Heme



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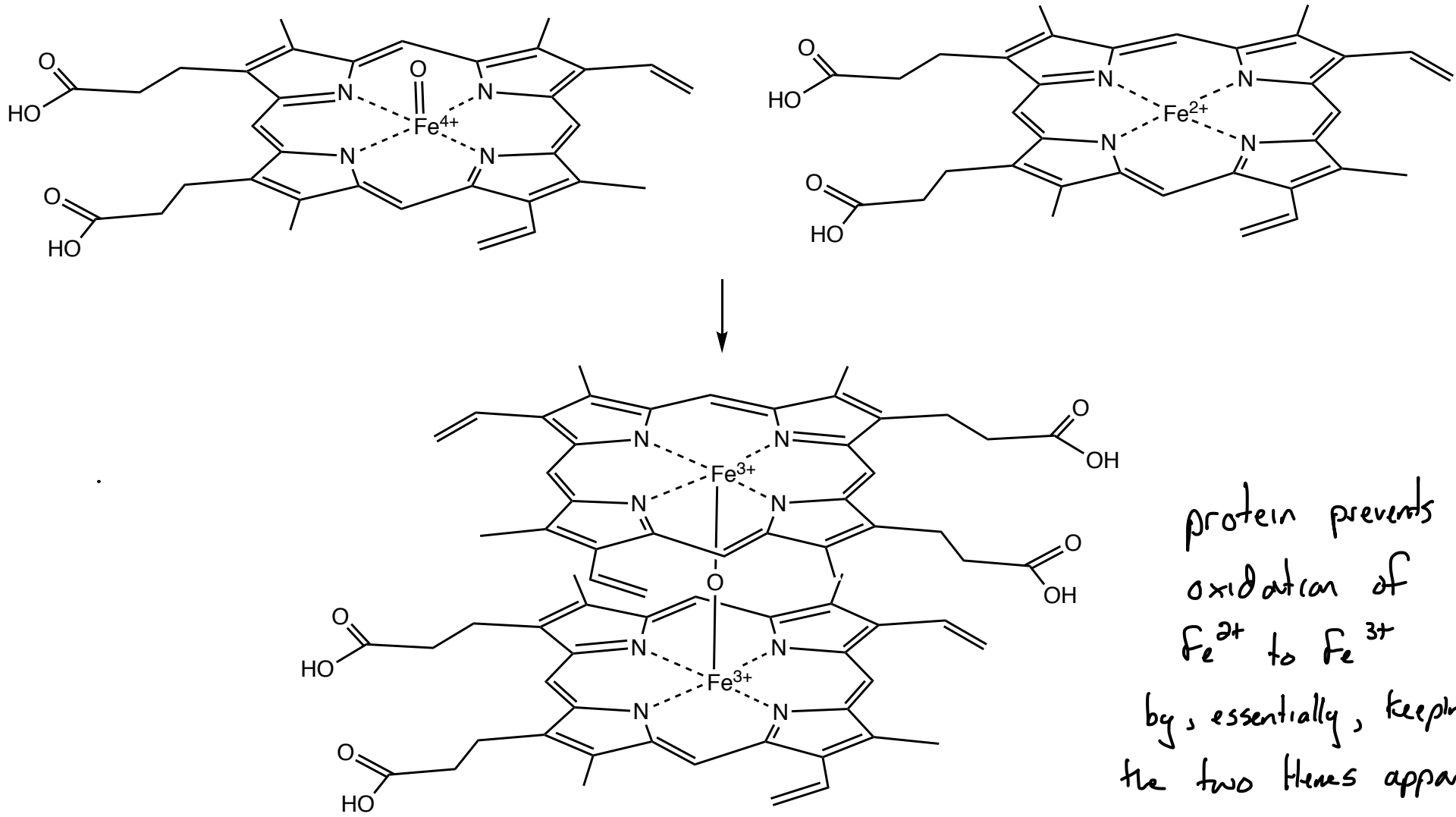
Free Heme

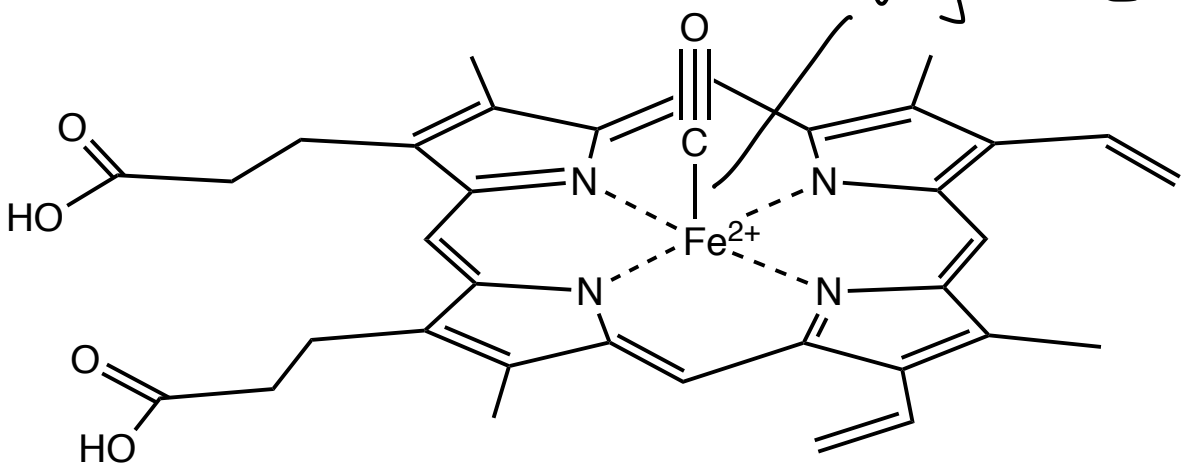


protein prevents oxidation of Fe^{2+} to Fe^{3+} by, essentially, keeping the two Hemes apart

Binding CO

CO binds 50,000 x as strongly as O_2

very strong π back bonding



protein prevents linear alignment of C≡O (and O_2) ... weakens π backbonding

CO binds 500 x as strongly as O_2