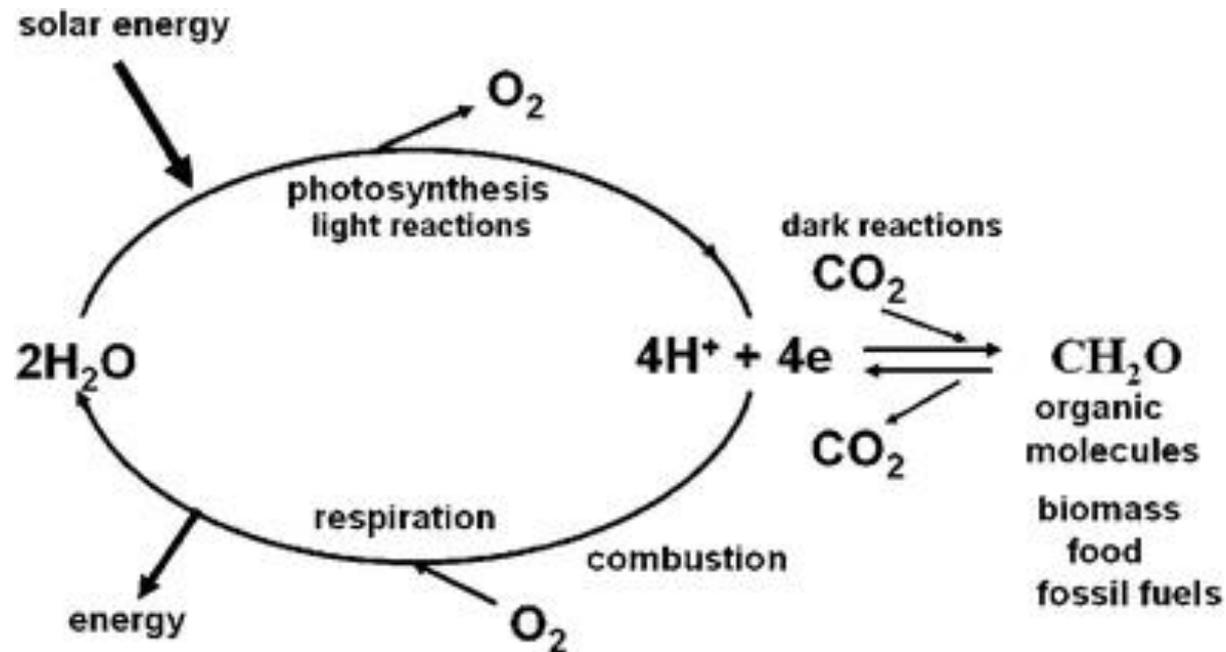
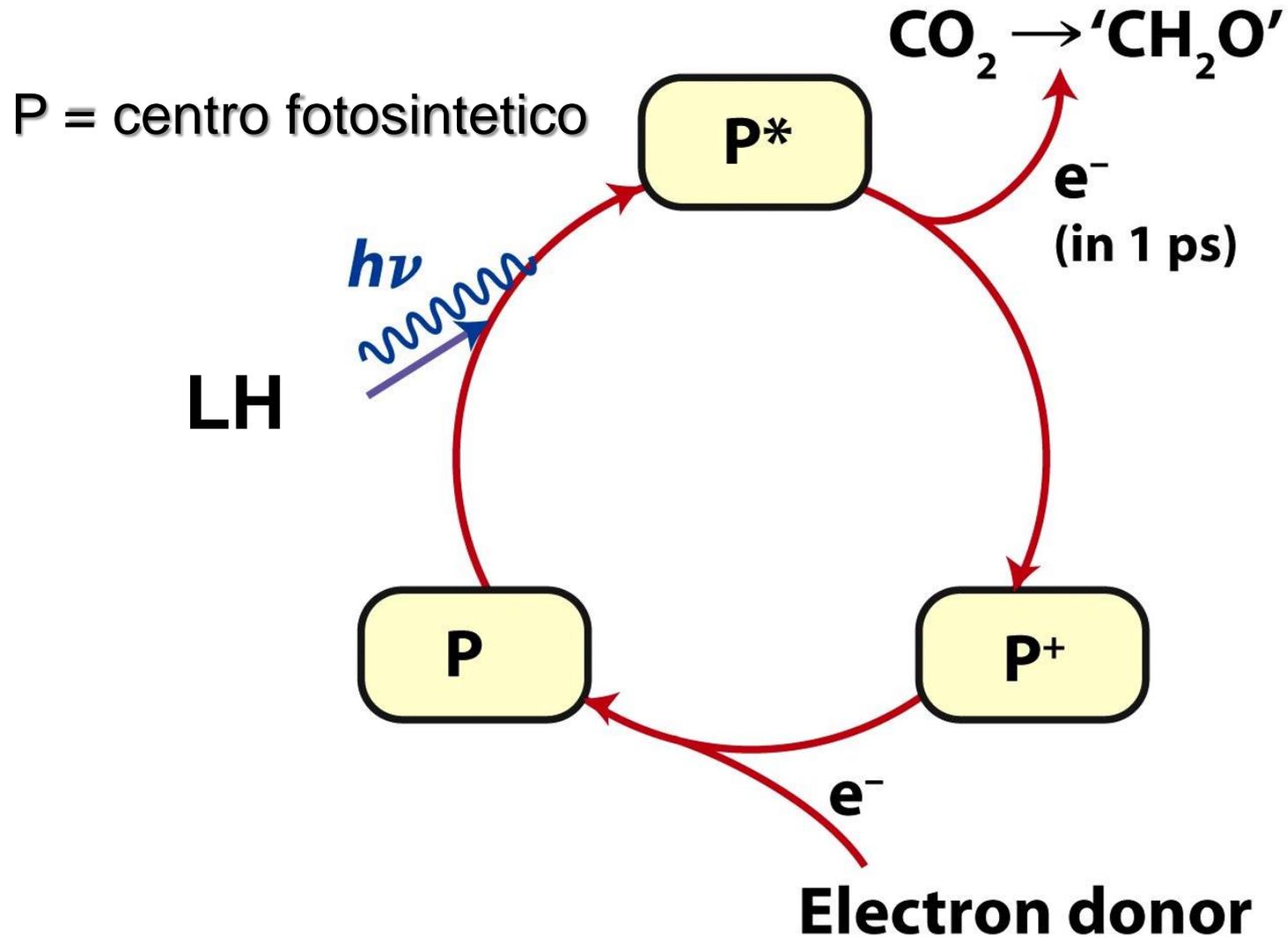


200×10^9 ton/y di $(\text{CH}_2\text{O})_n$ da CO_2
 1 g di glucosio per m^2 di superficie fogliare all'ora
 $100 \text{ TW/y} = 0.1\%$ energia solare totale (10^5 TW)



Separazione di carica fotoindotta



Processo fotosintetico nelle piante

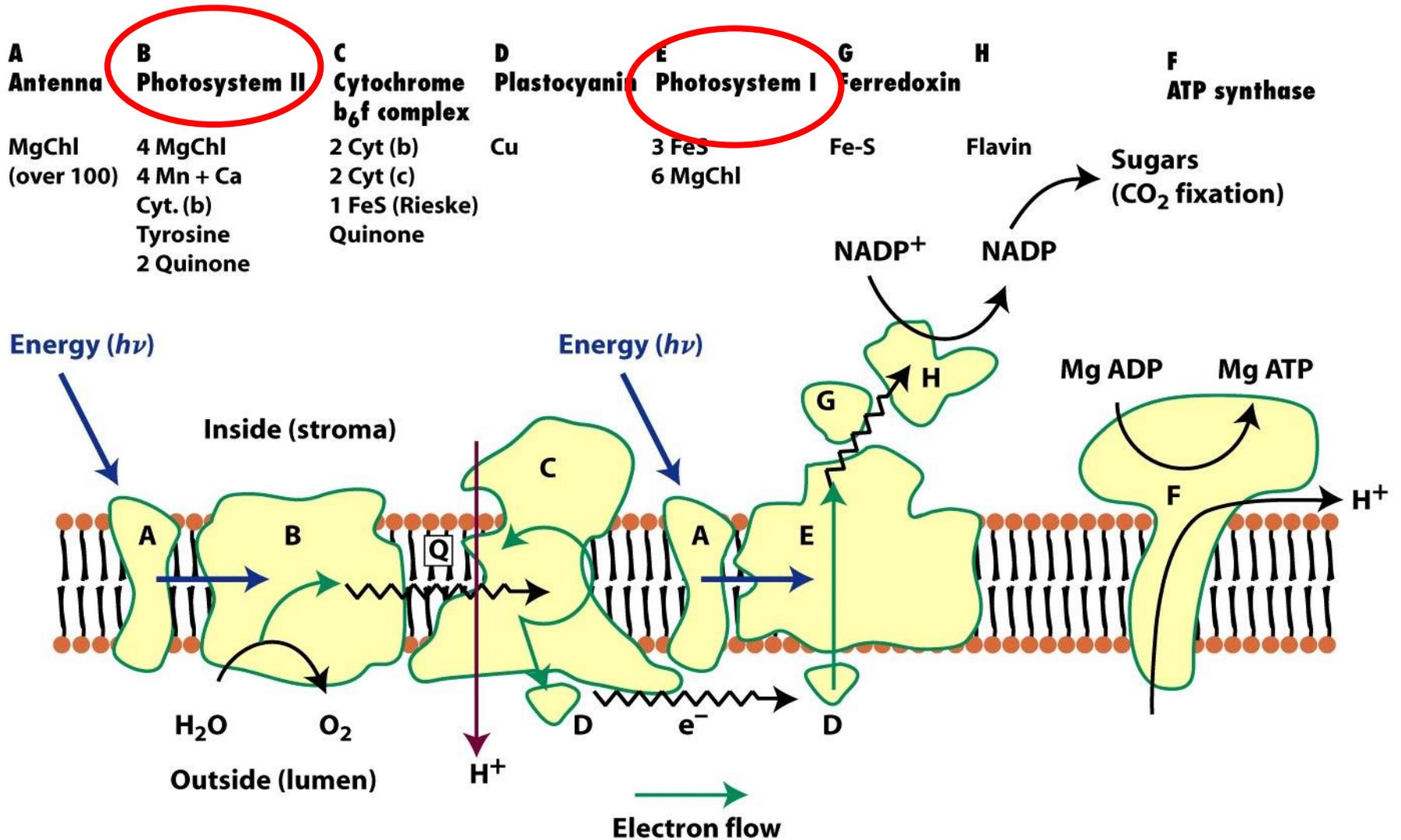
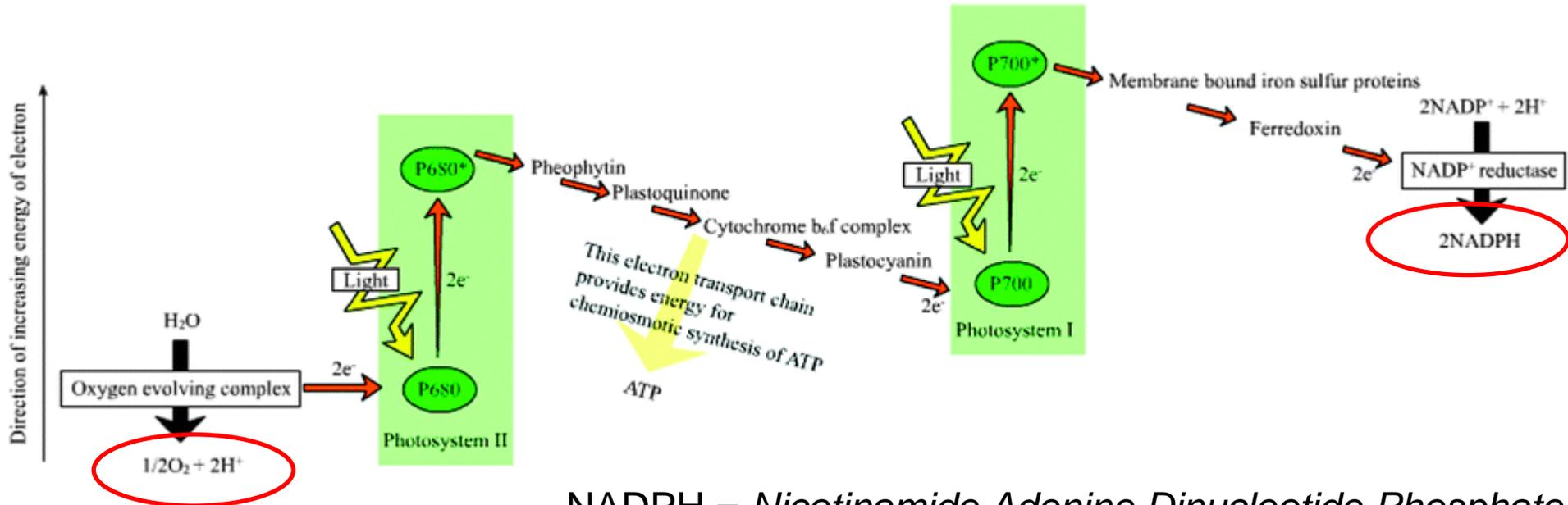
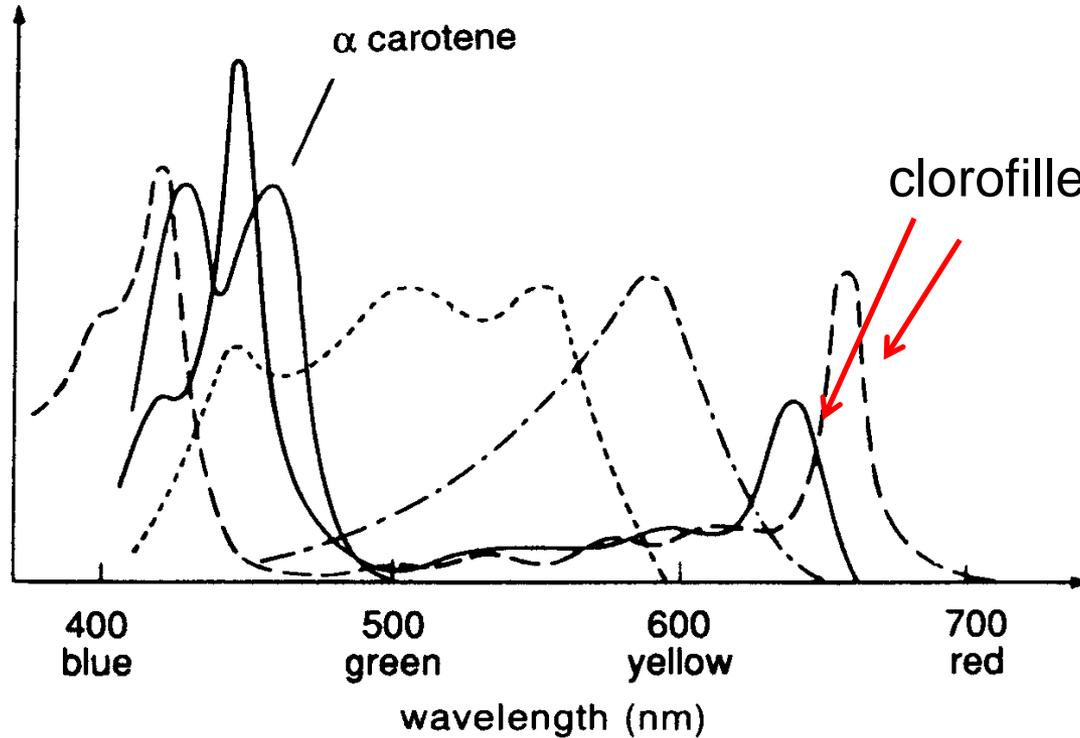
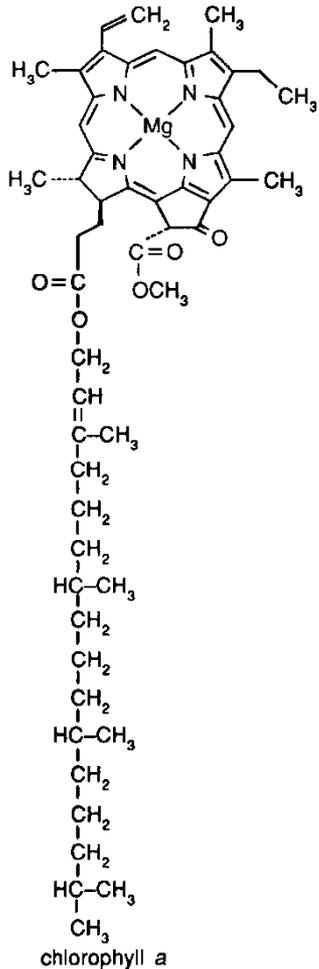


Diagramma "a Z"



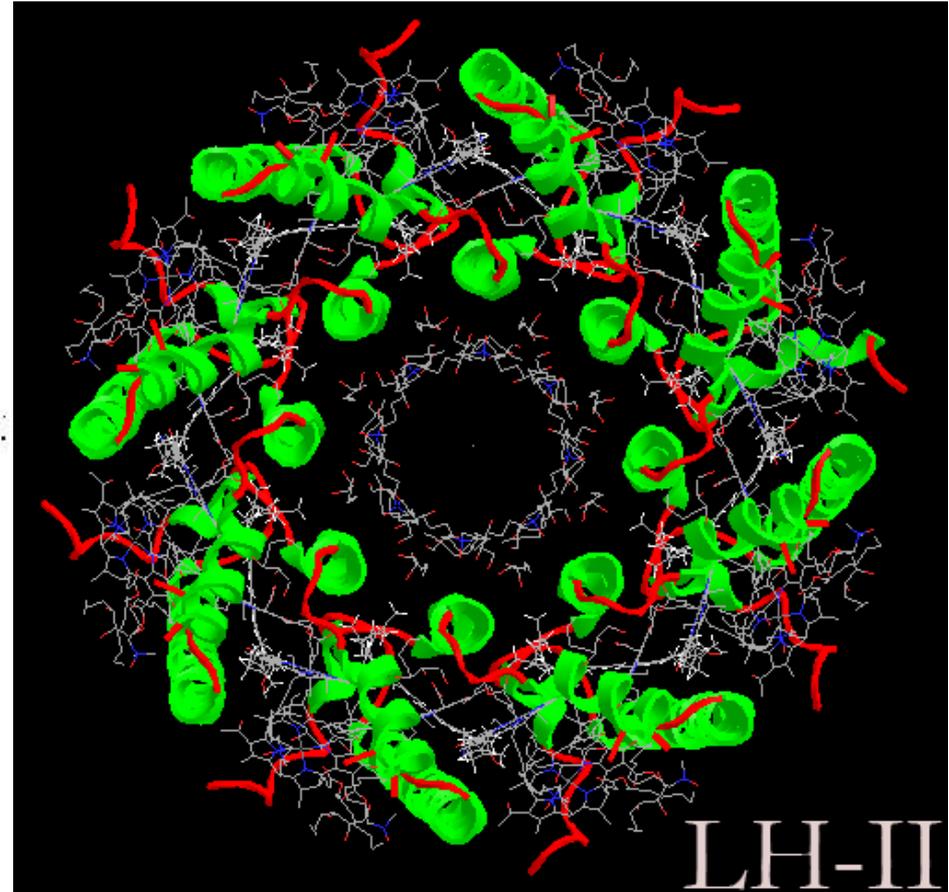
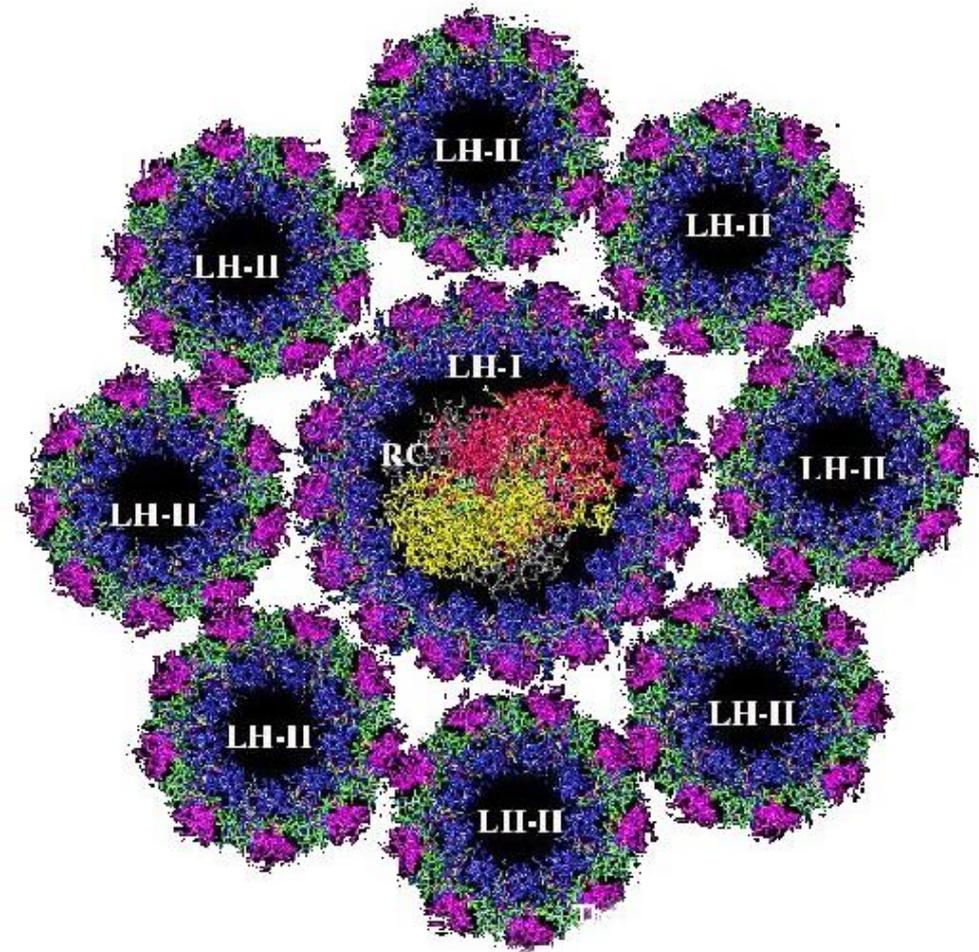
NADPH = *Nicotinamide Adenine Dinucleotide Phosphate*

Pigmenti deputati al *light harvesting*

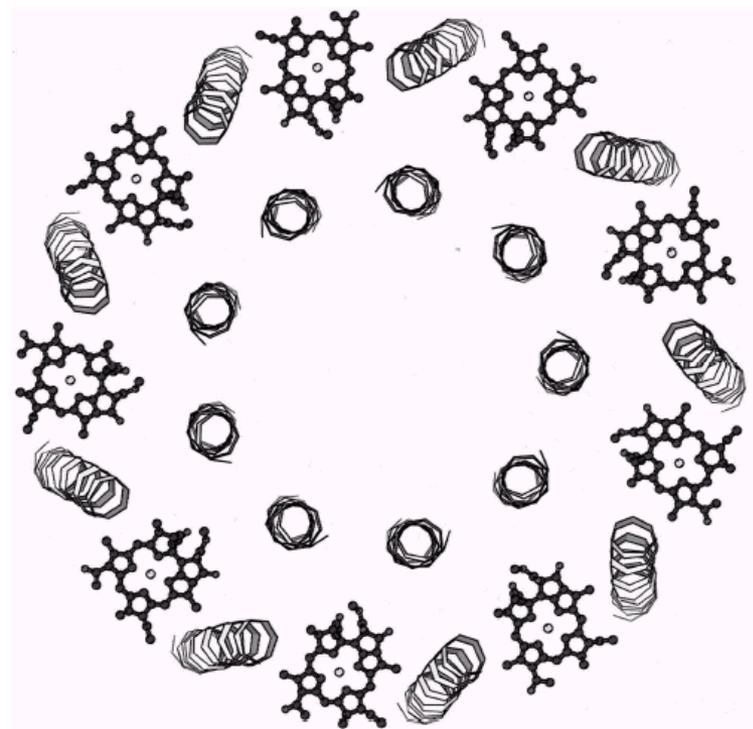
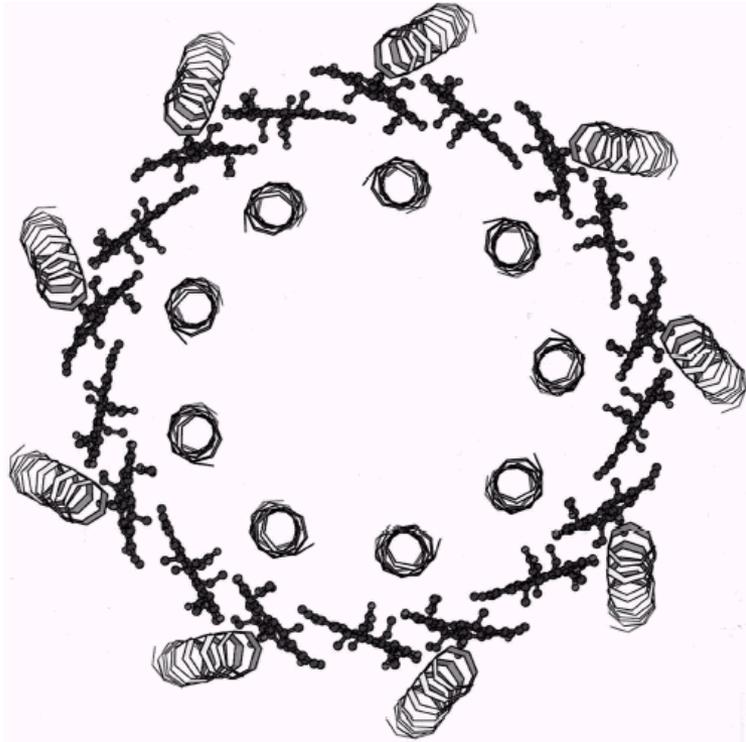


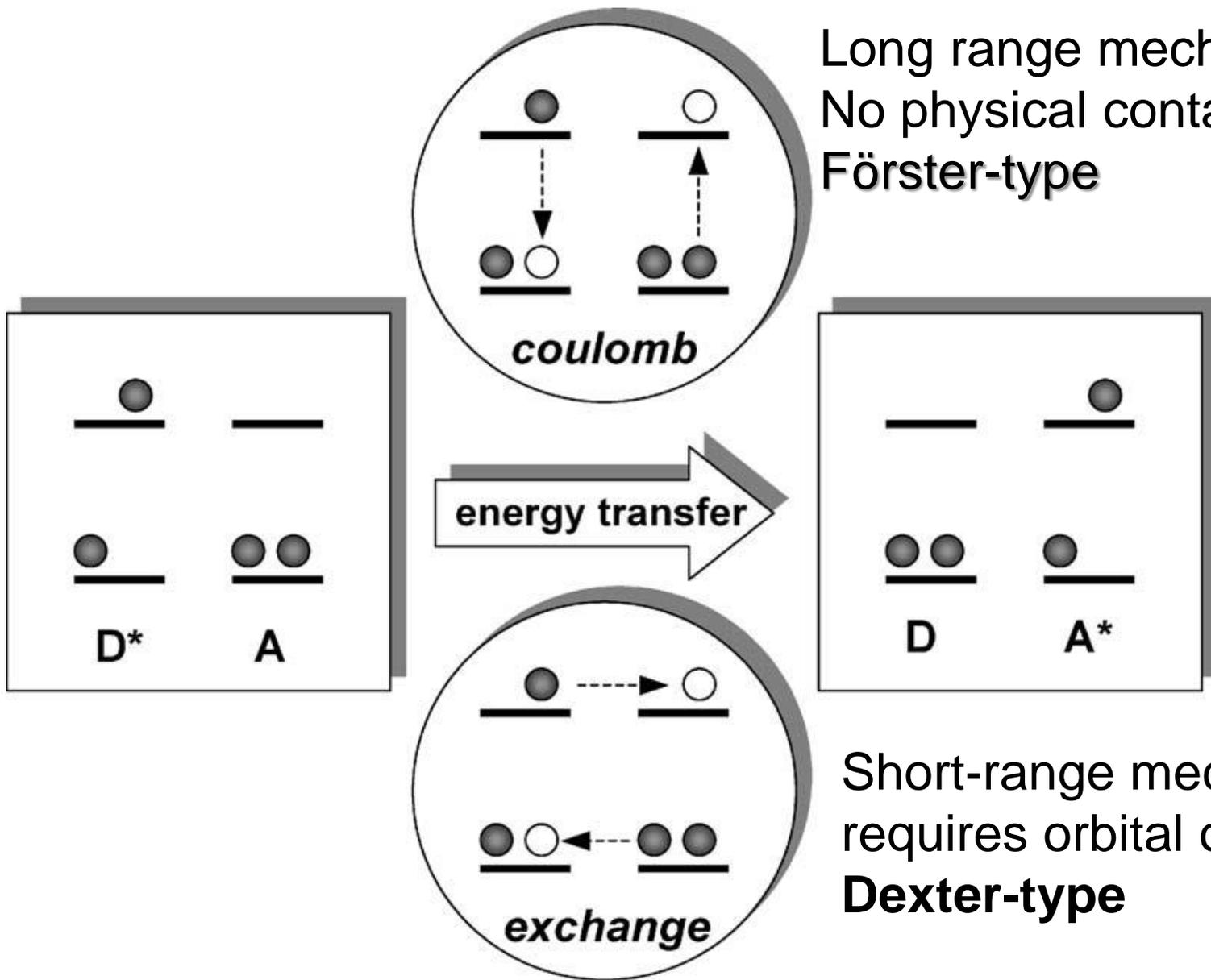
Absorption spectra of various pigments from algae and plants (according to [11]): chlorophyll *a* (— —), chlorophyll *b* (—), α -carotene (— · —), phycocyanin (- · - ·), phycoerythrin (- - - -)

Sistemi antenna



Sistemi antenna

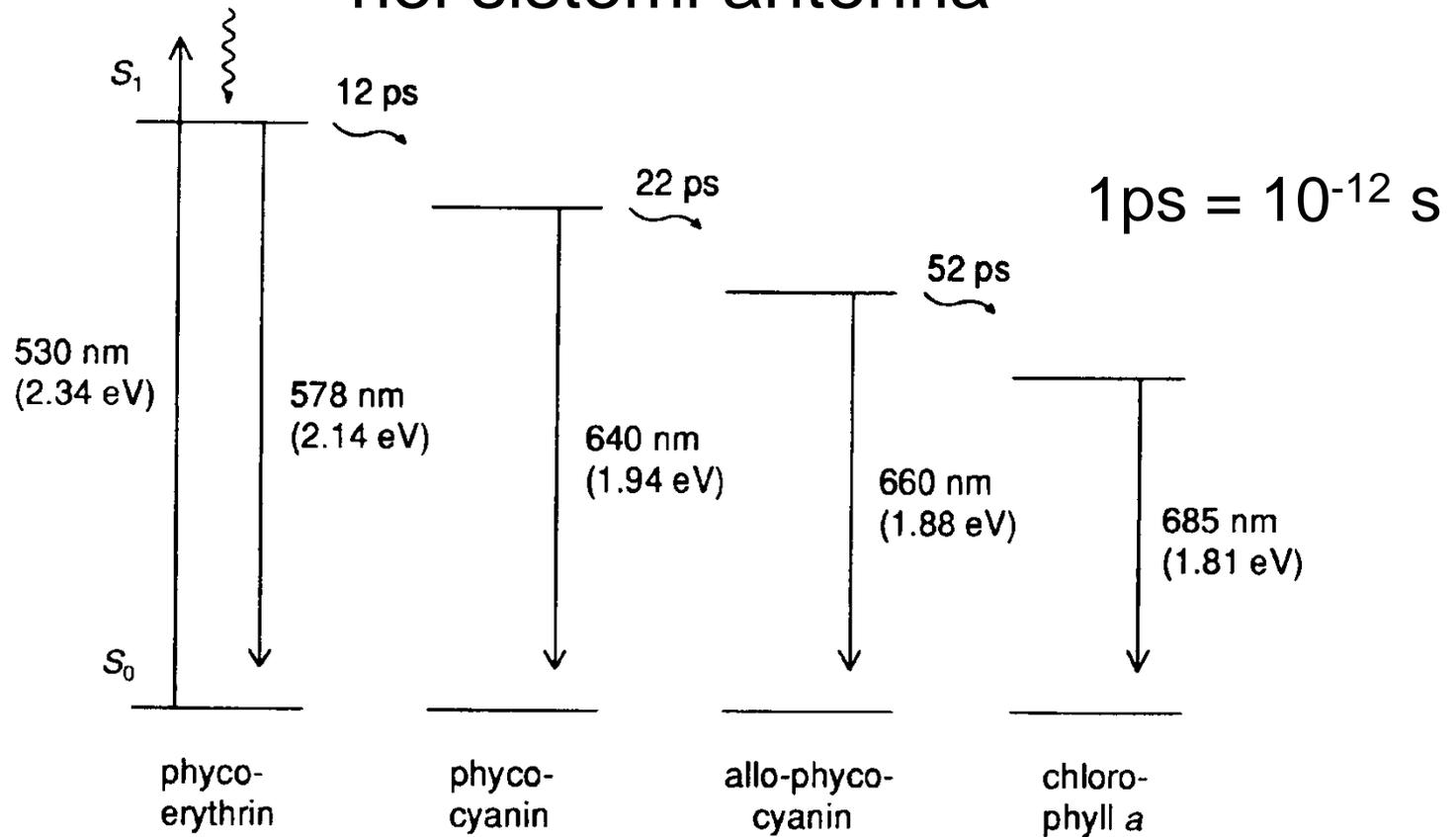




Long range mechanism
No physical contact
Förster-type

Short-range mechanism
requires orbital overlap
Dexter-type

Trasferimento di energia (*exciton transfer*) a cascata nei sistemi antenna

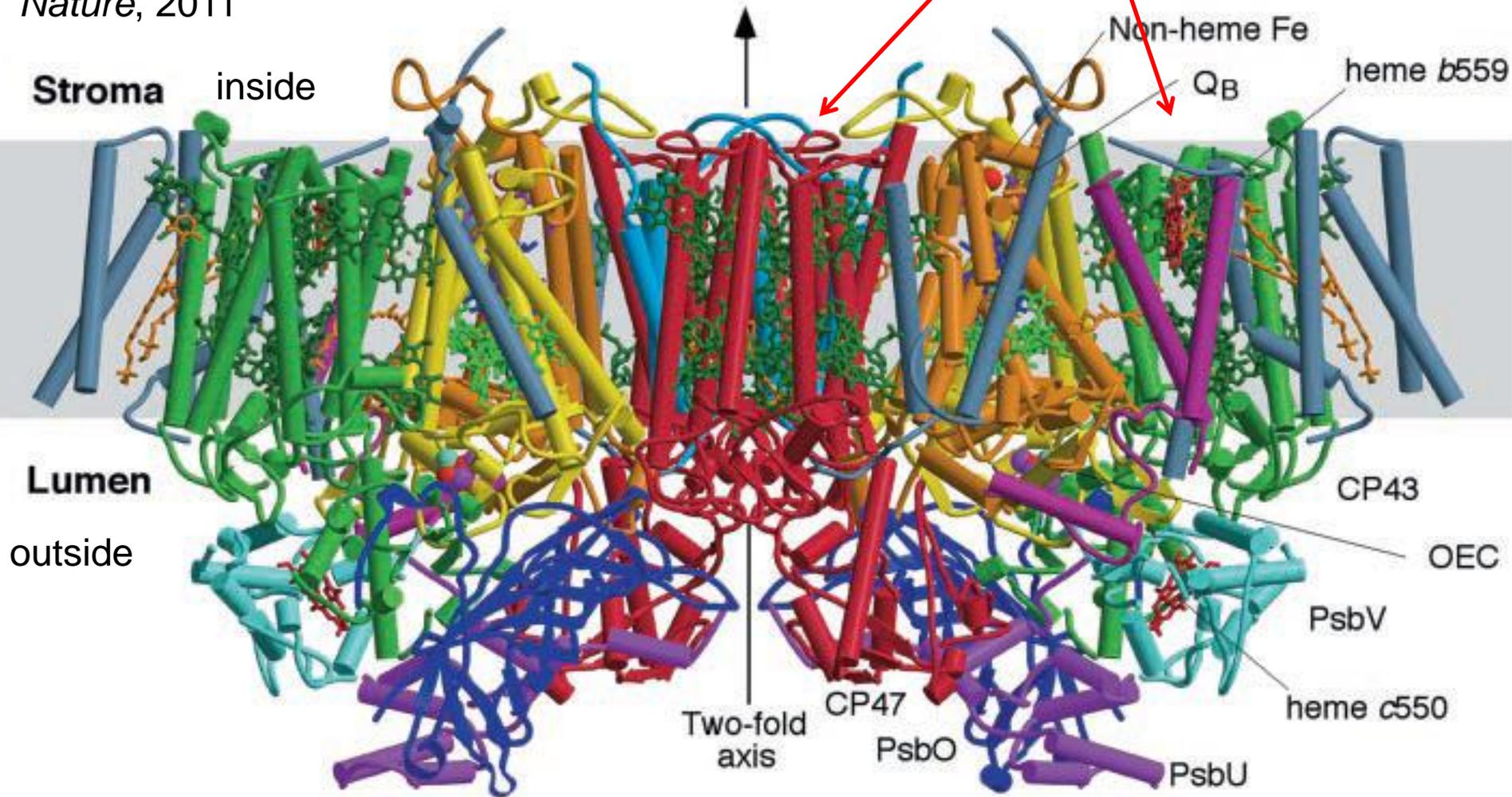


efficienza del 95%

PS II

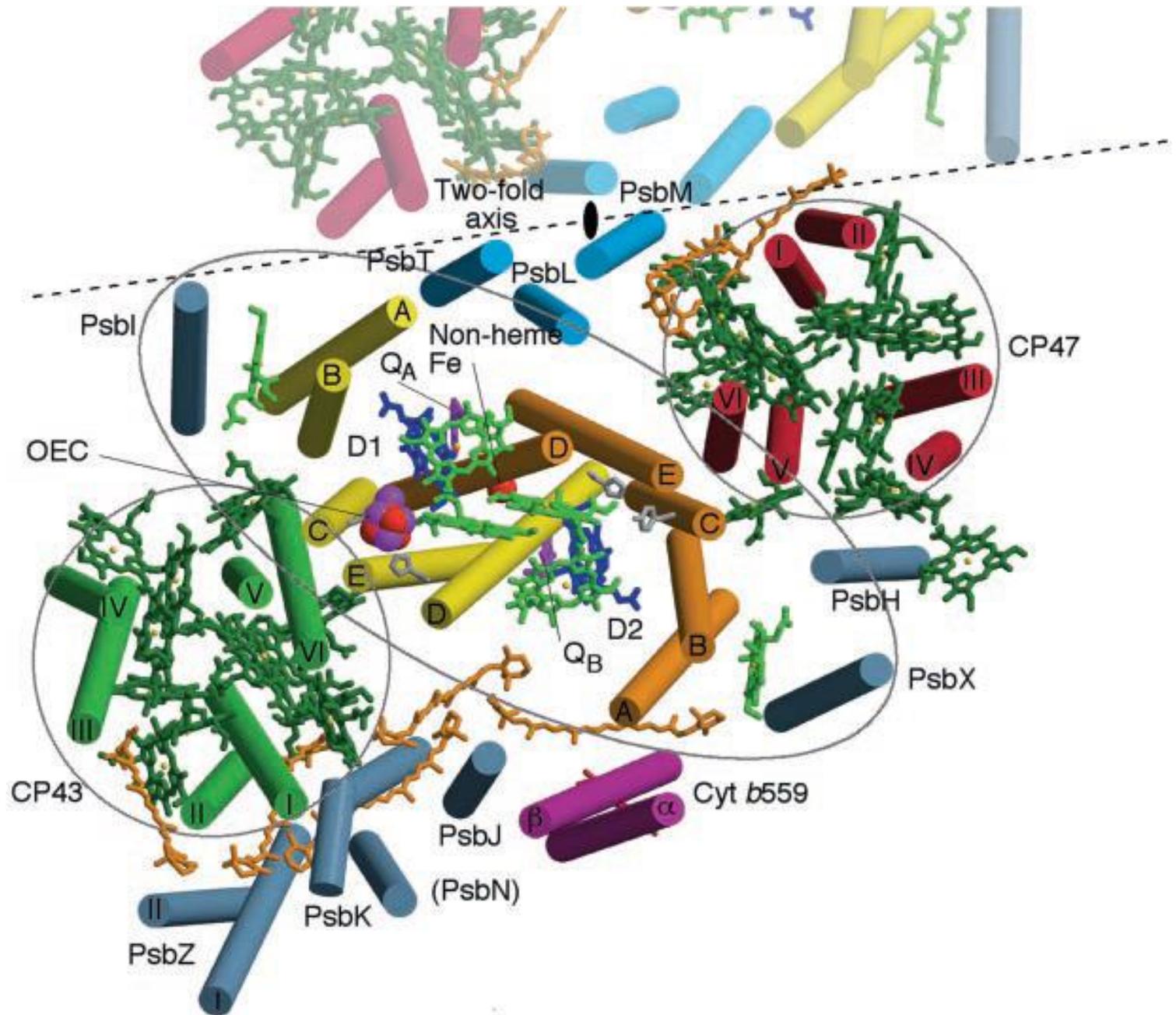
Sistemi antenna

Nature, 2011



19 subunità proteiche, 2 feofitine, 36 clorofille, 11 carotenoidi, vari cofattori

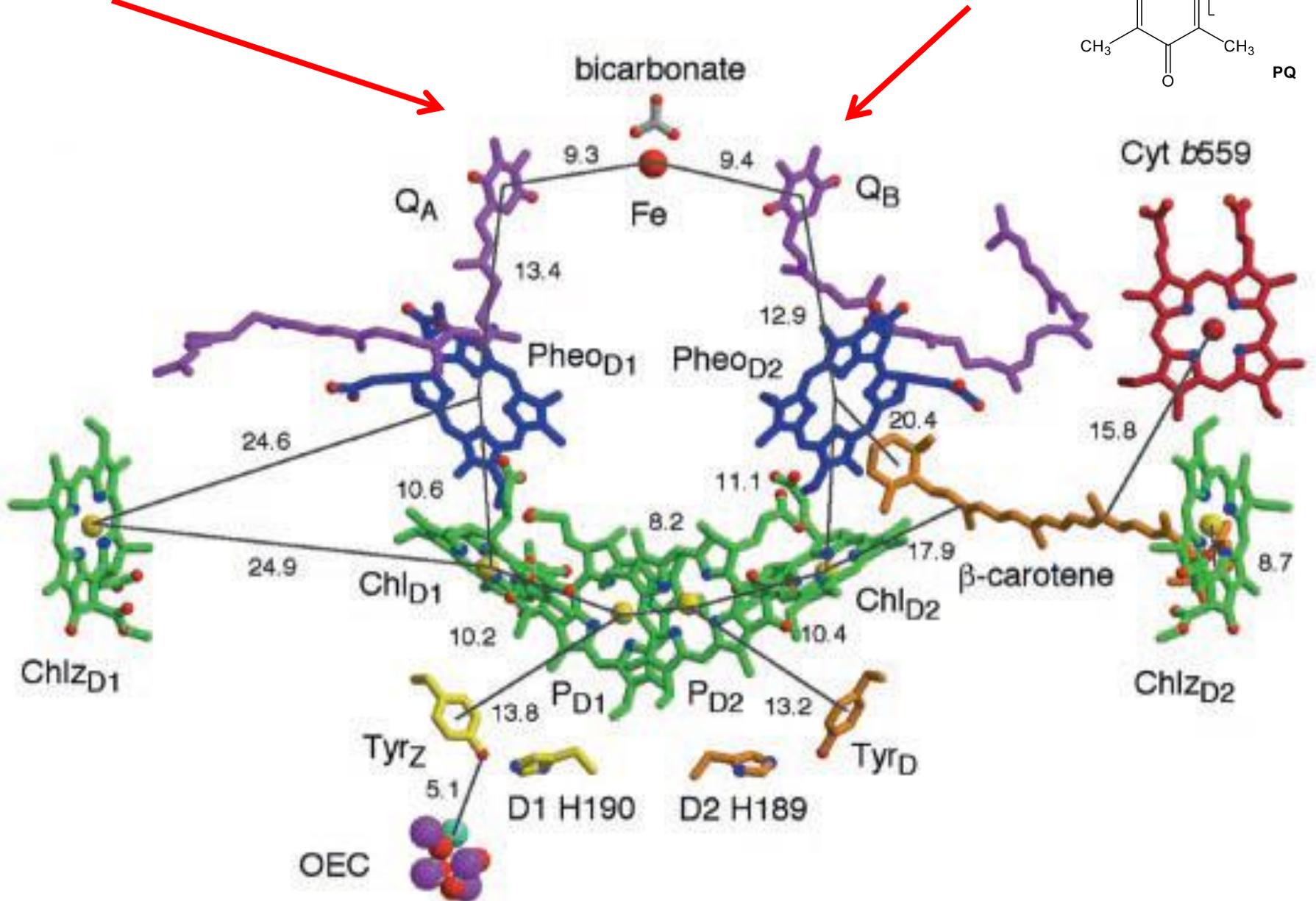
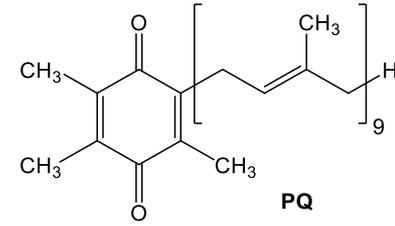
PS II



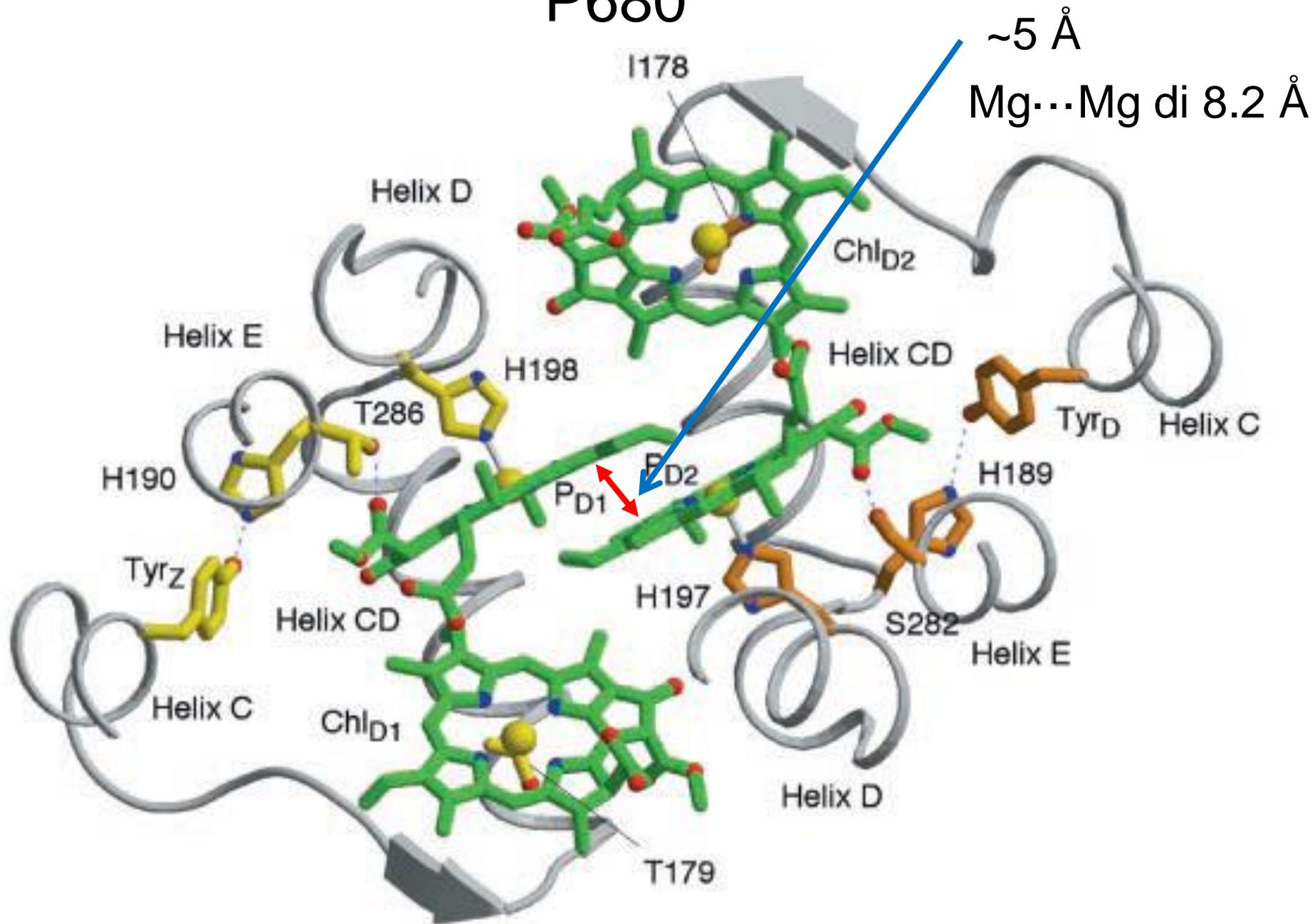
P680

Plastochinone fisso

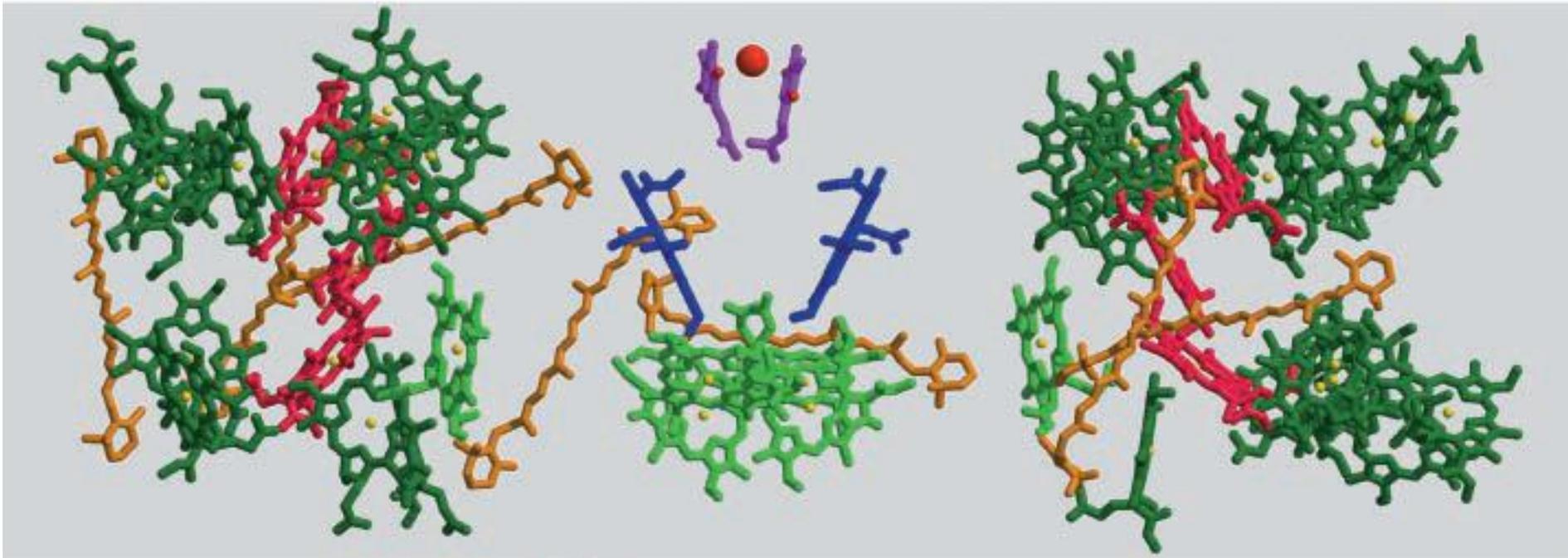
Plastochinone mobile



P680



inside **Stroma**



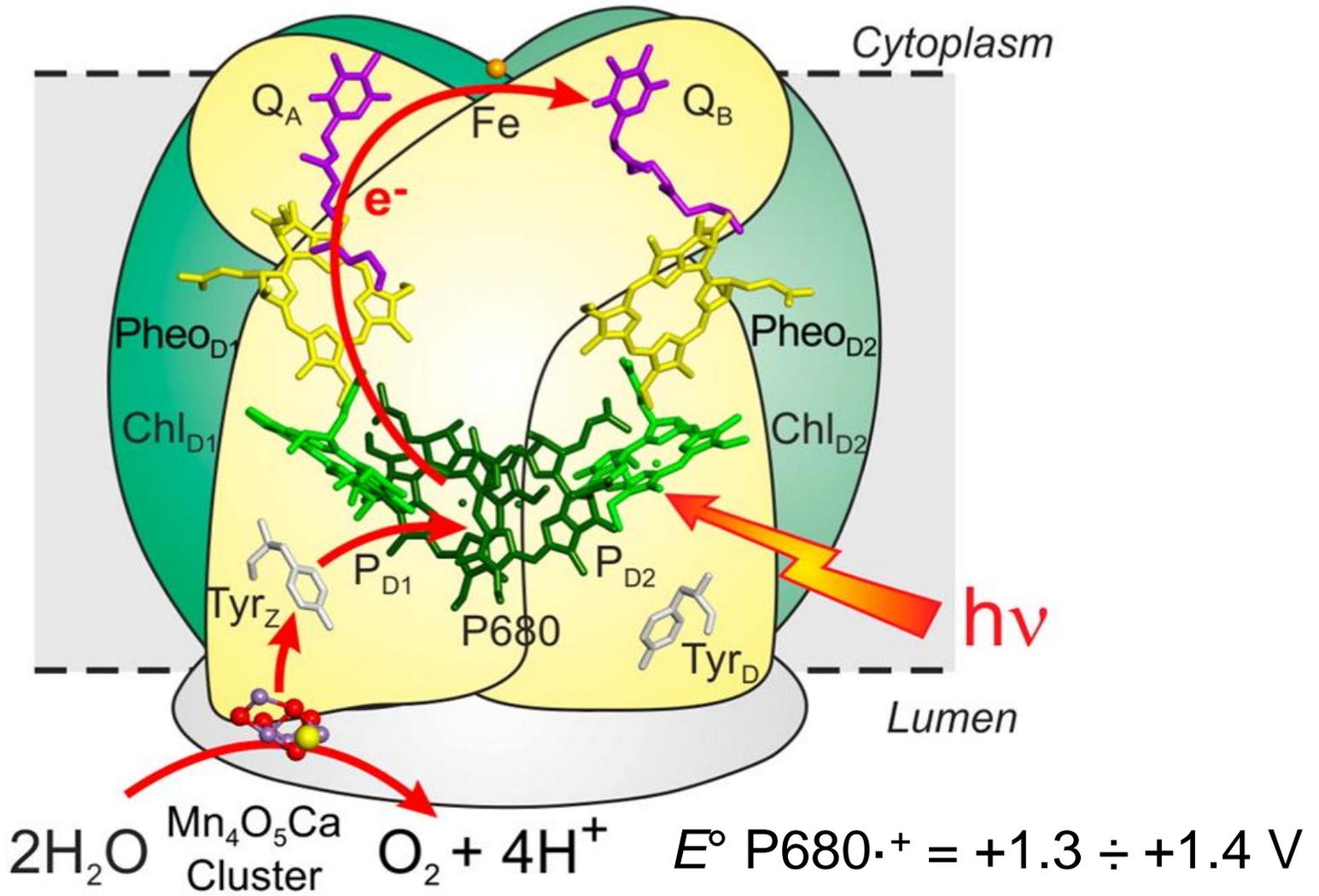
CP43



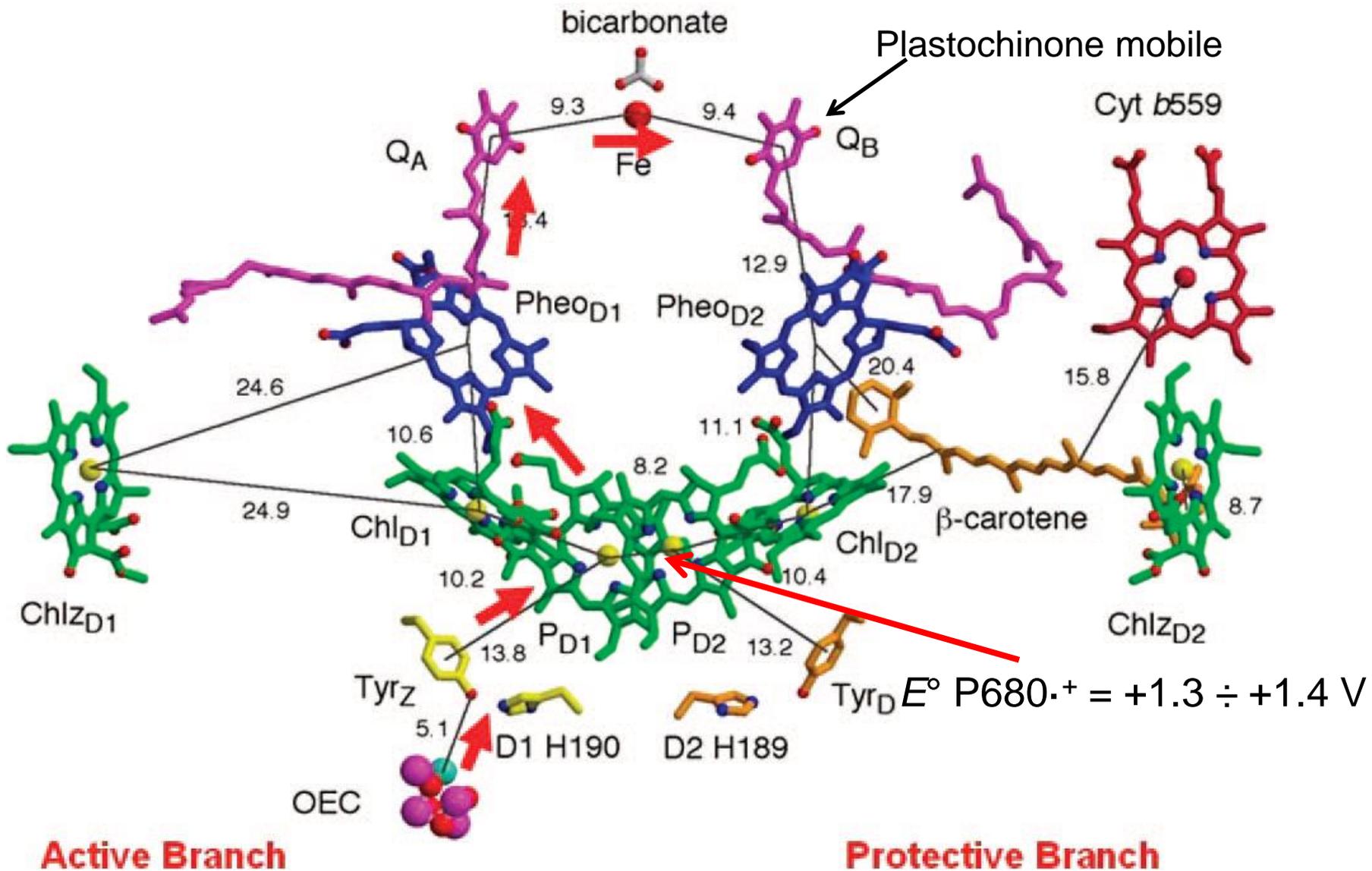
D1/D2

CP47

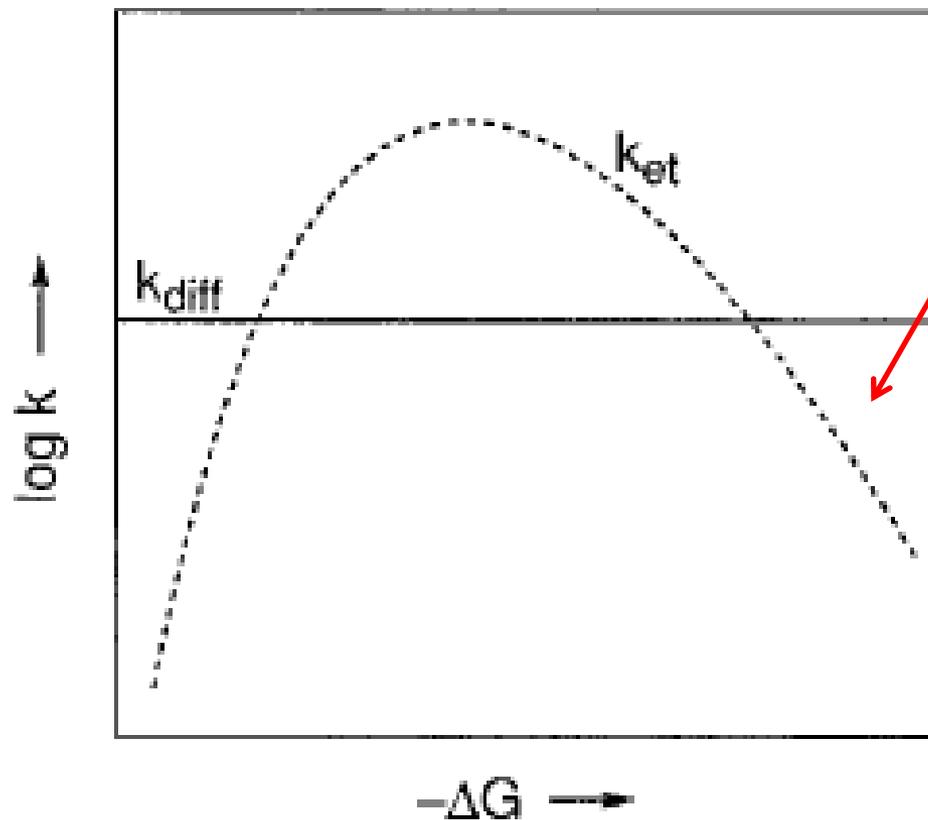
Lumen
outside



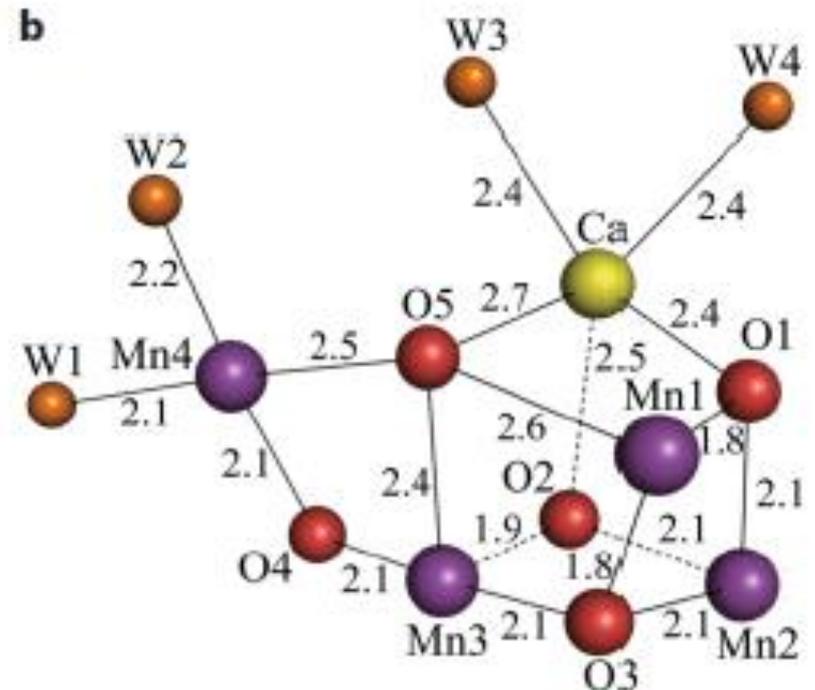
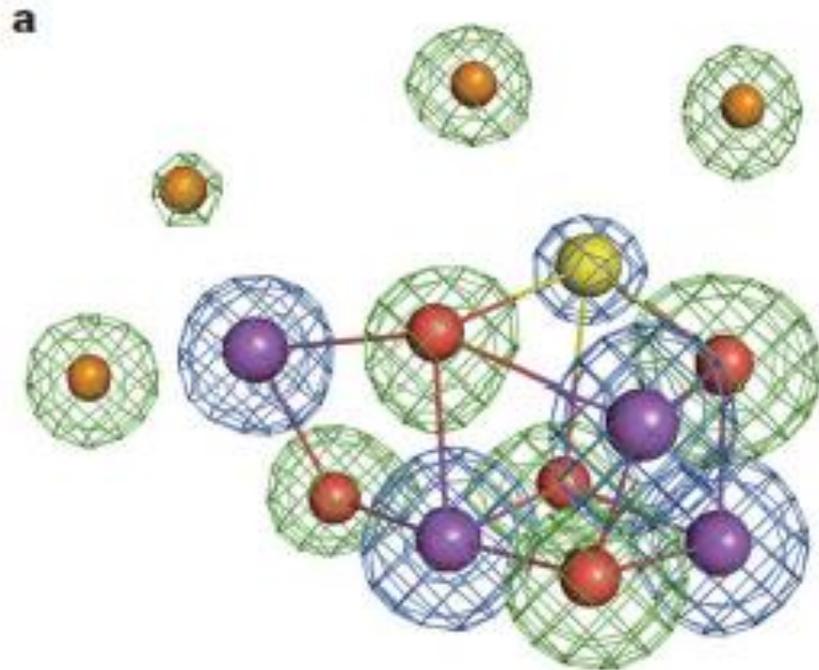
Electron transport cofactors

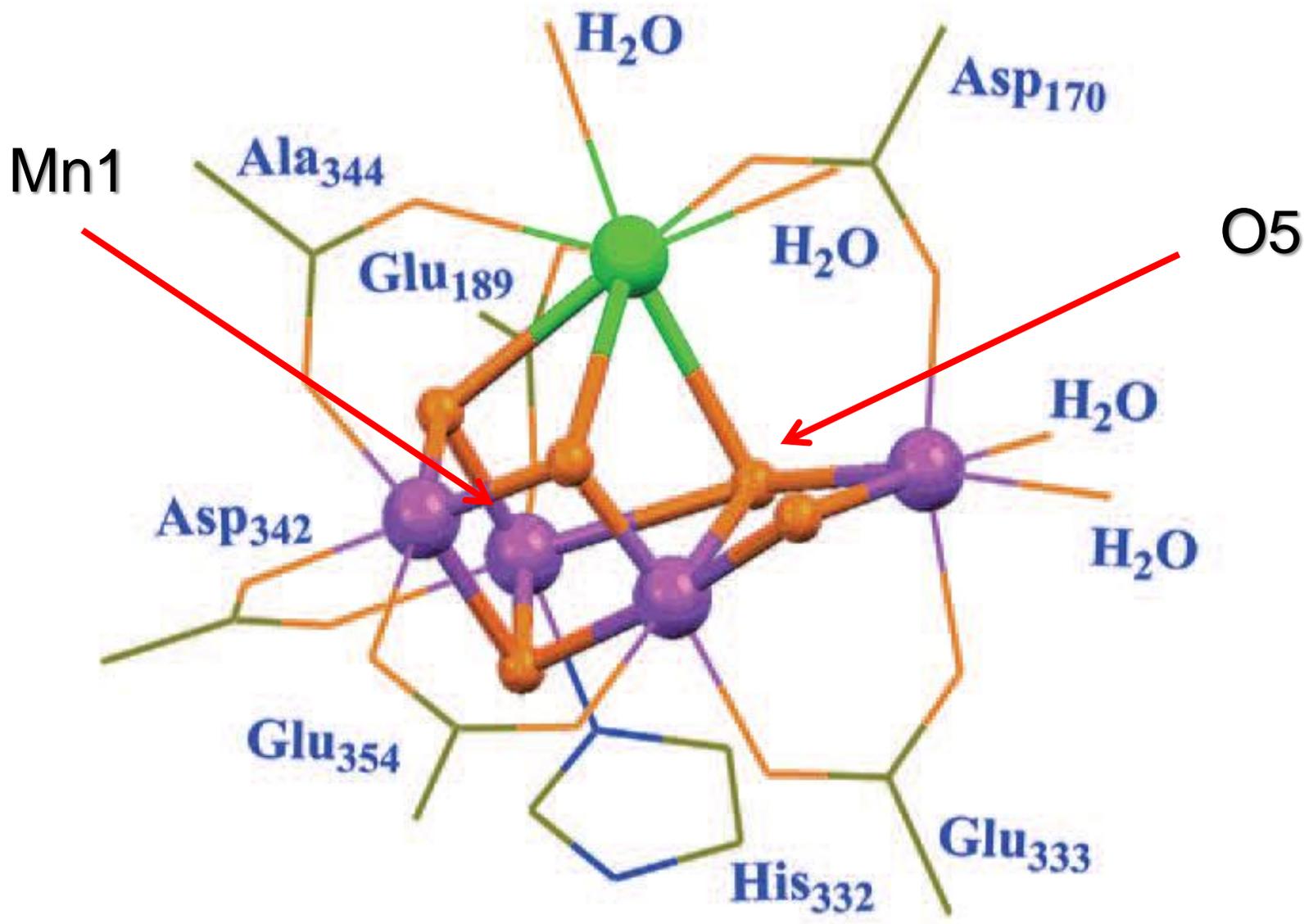


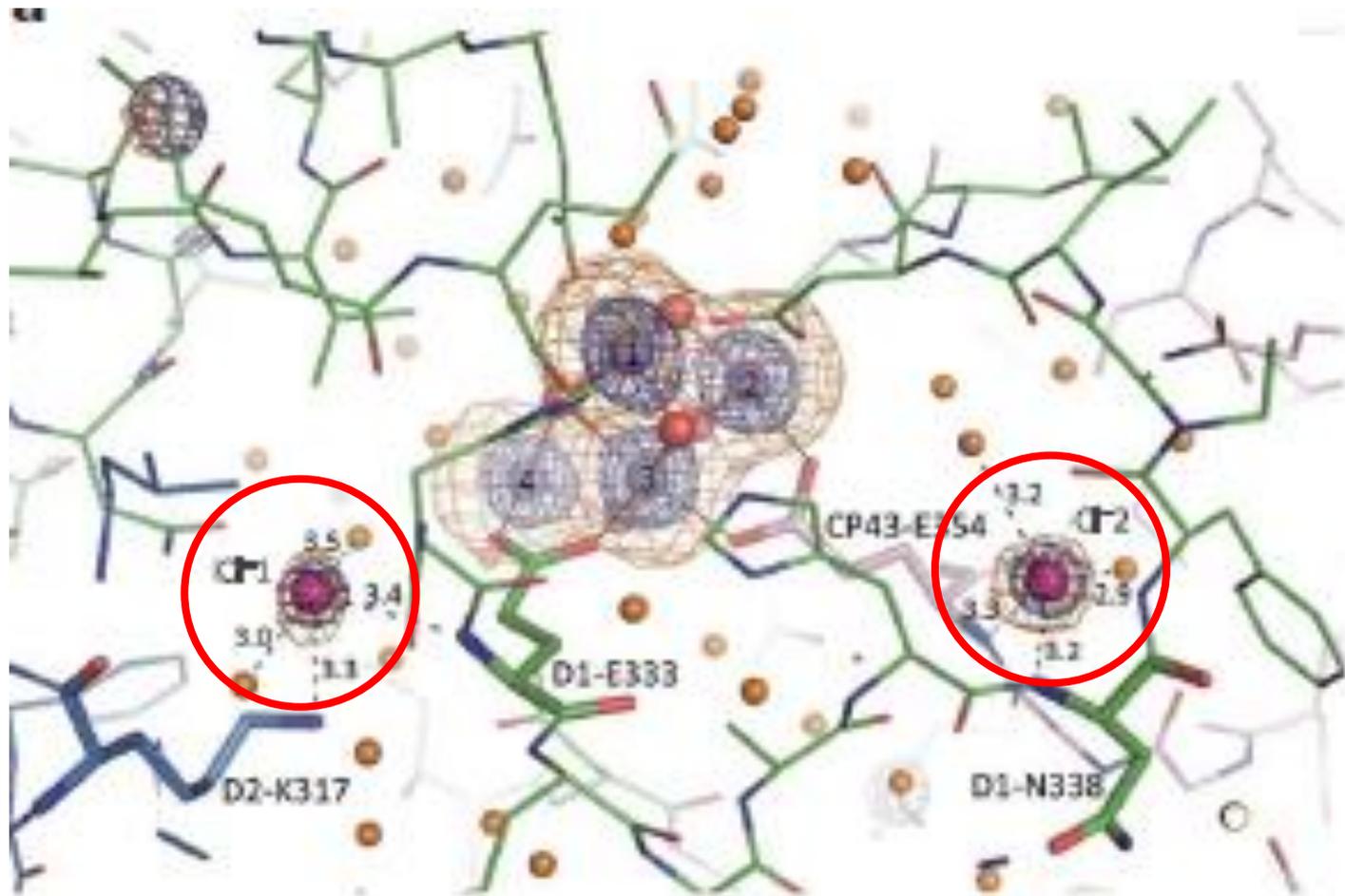
Regione inversa di Marcus



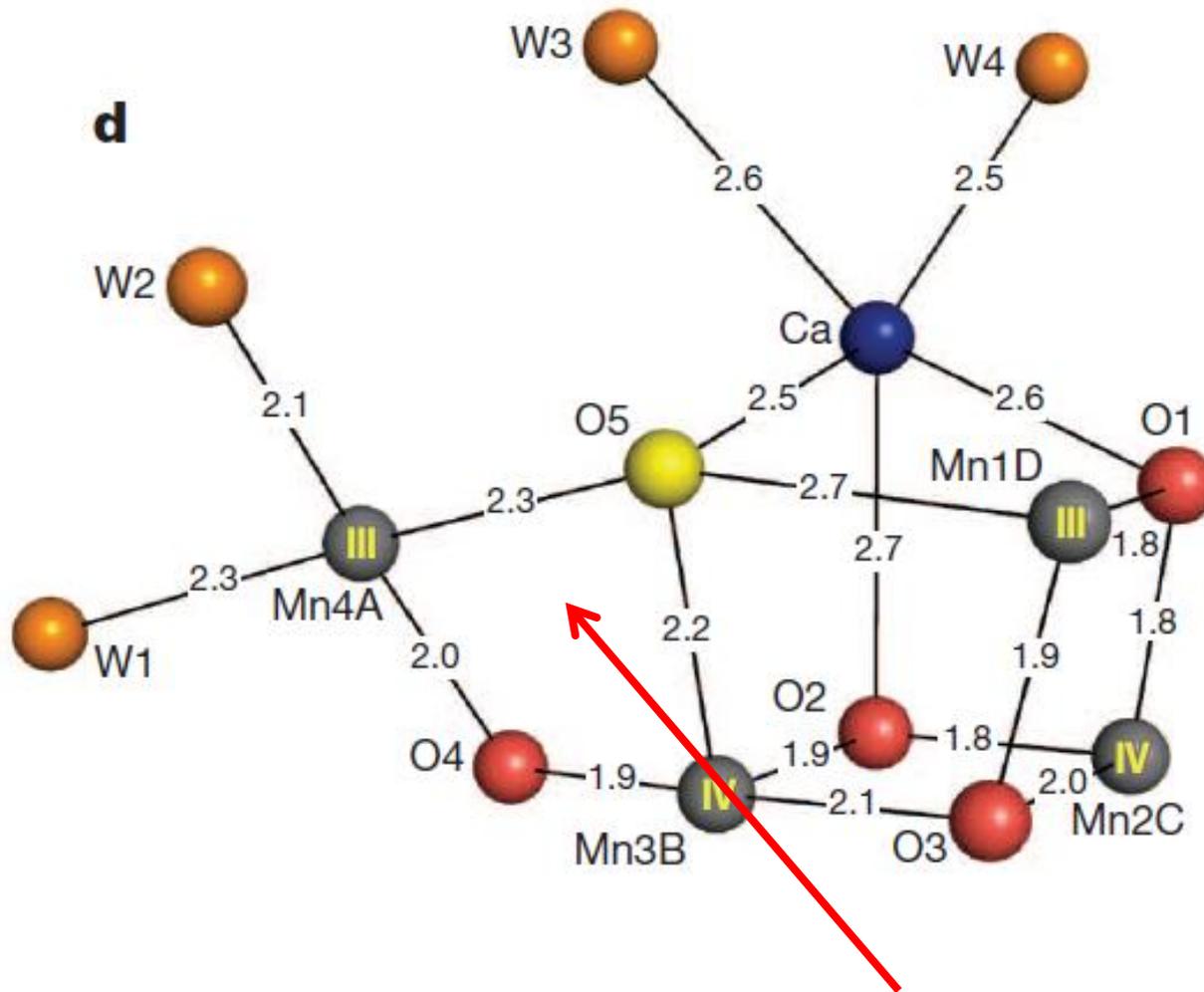
Oxygen Evolving Complex (OEC)







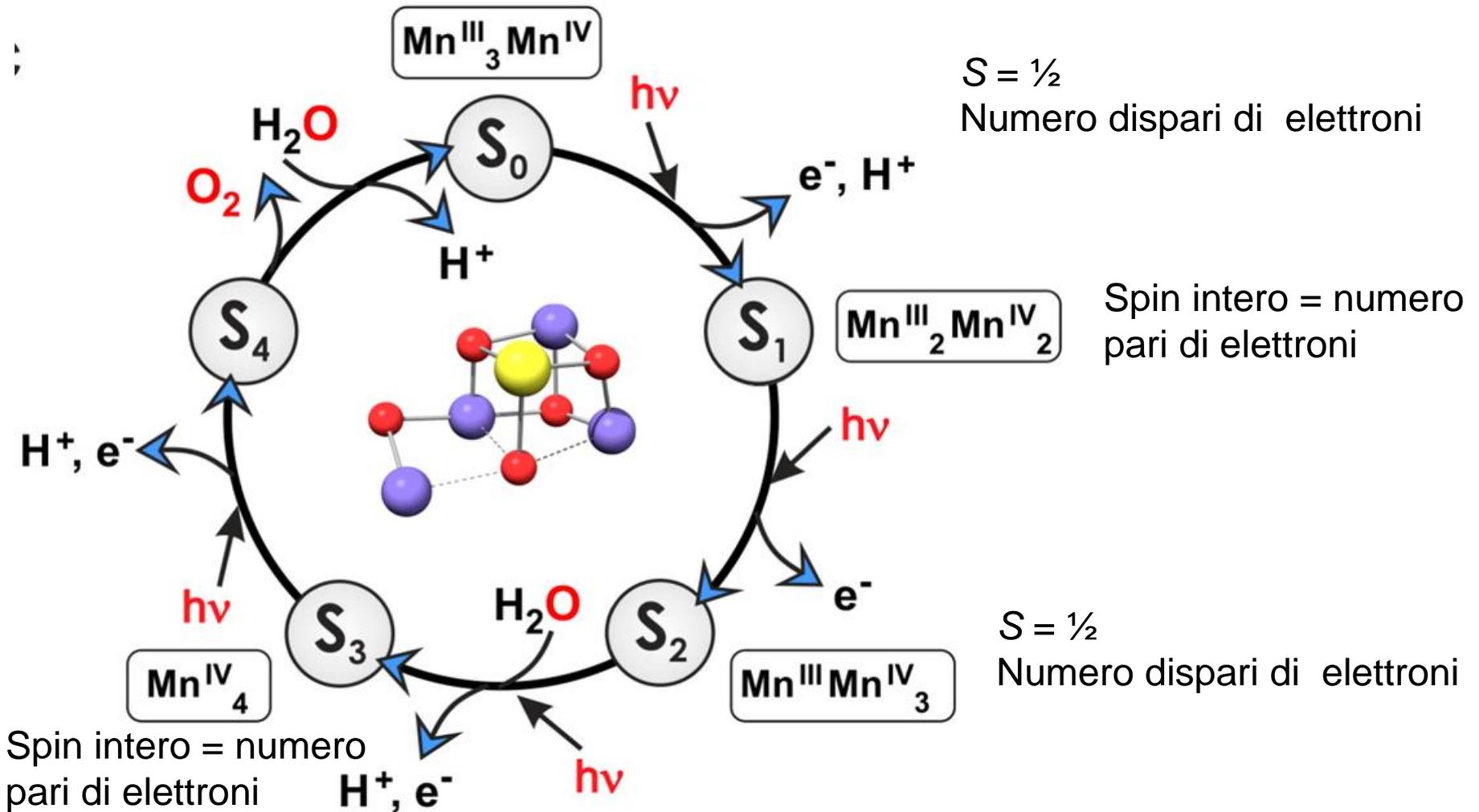
Mn(III), d^4 , alto spin \rightarrow effetto Jahn-Teller



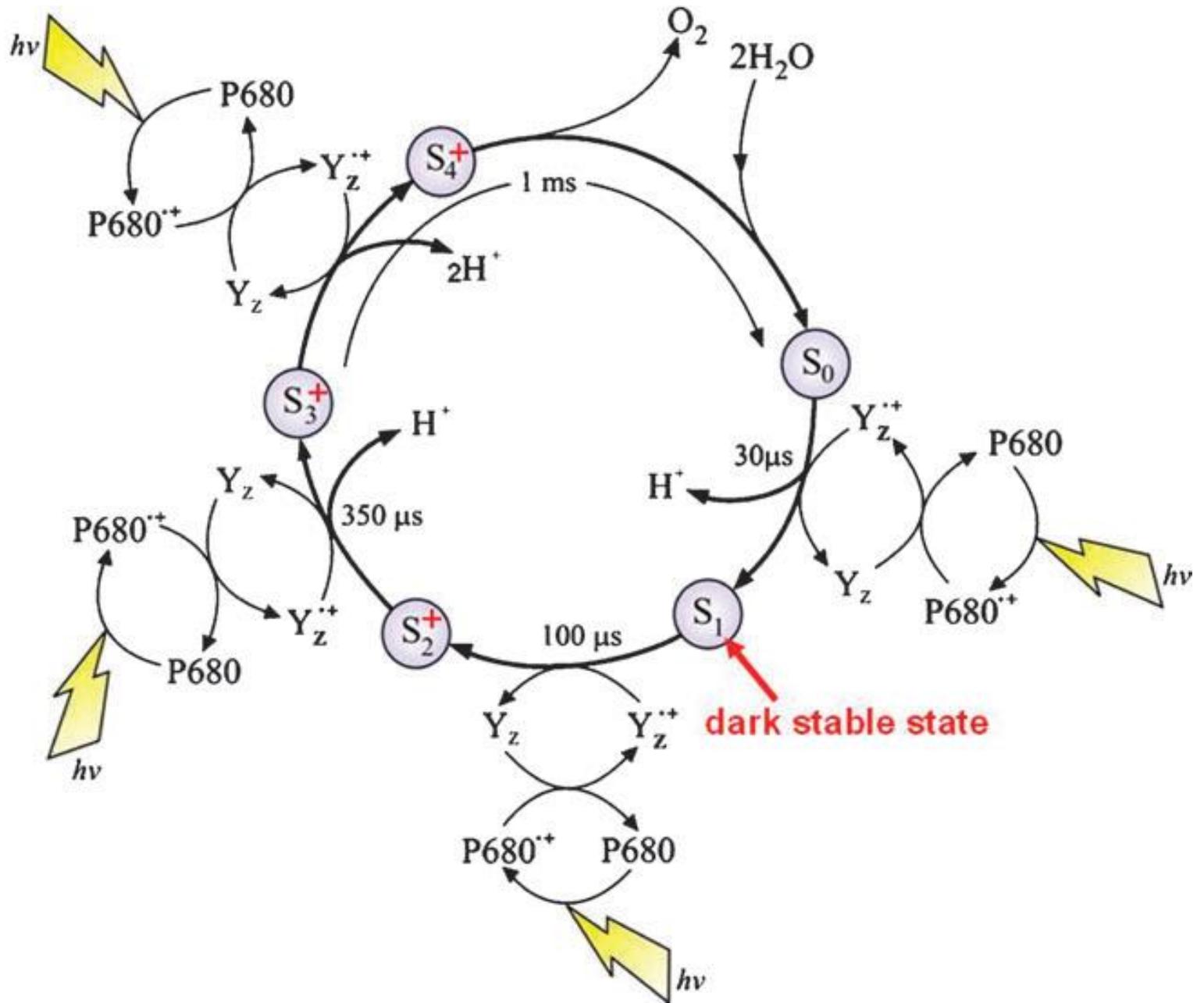
Nature 2015
X-ray free-electron laser (XFEL)

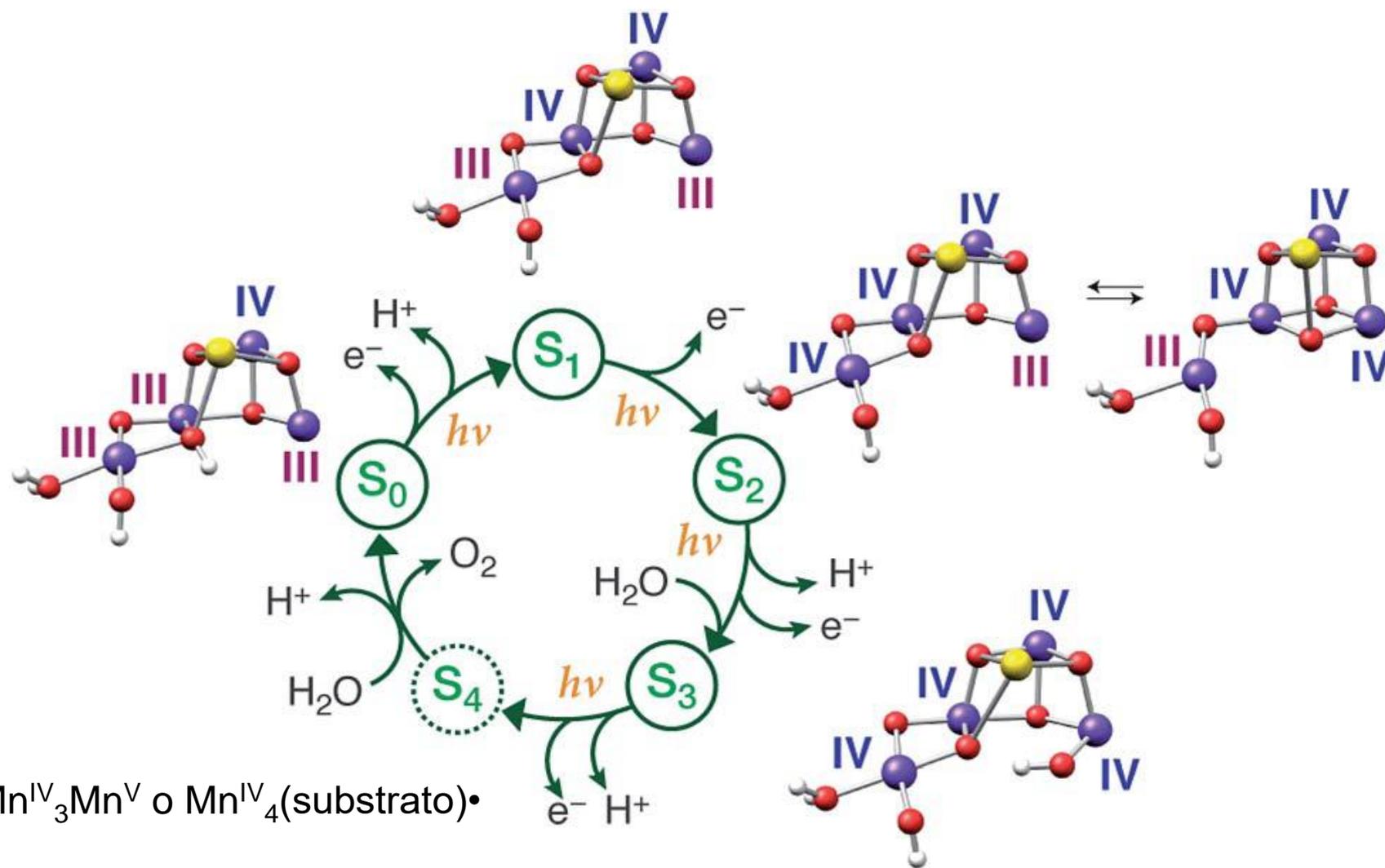
Mn4-O5 più corta di 0.2 Å

Ciclo di Kok o *S clock*



OEC ossida fino a 1000 molecole di H_2O per secondo!
TON \approx ca. 10^6

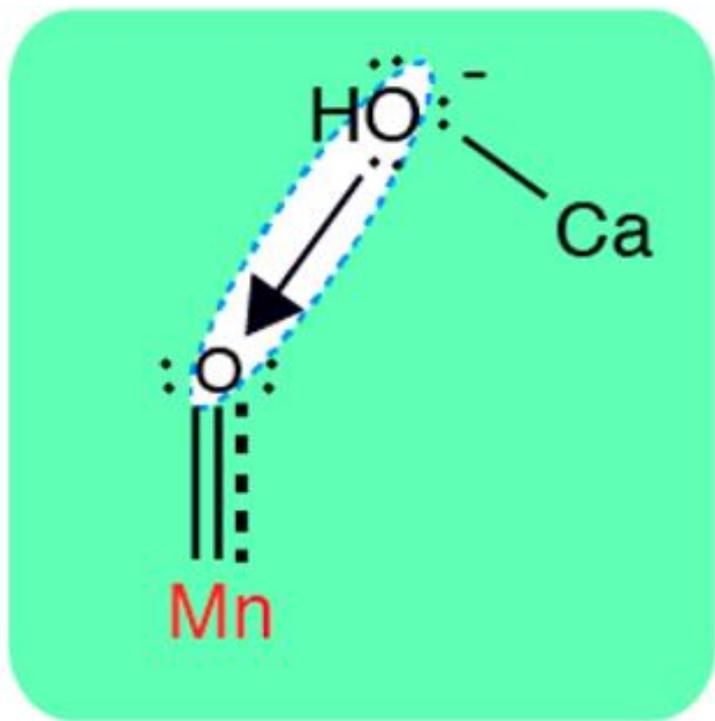




$Mn^{IV}_3Mn^V$ o $Mn^{IV}_4(\text{substrato})\bullet$

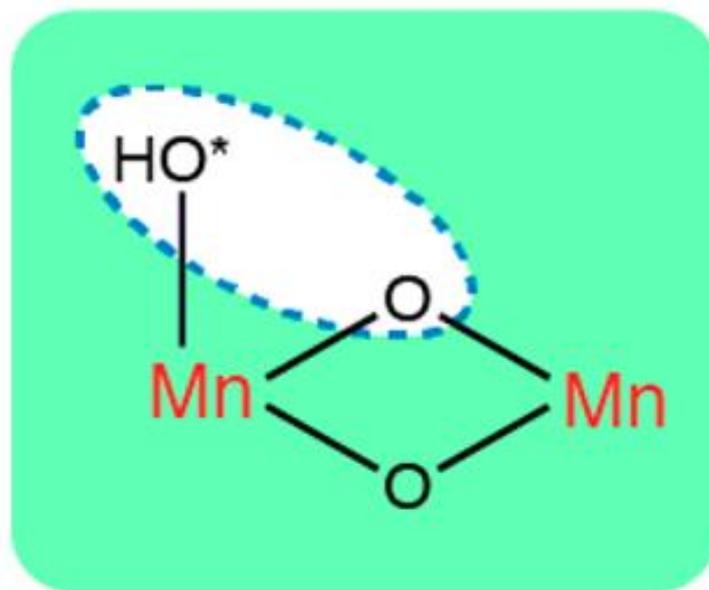
Ipotesi di formazione del legame O–O

nucleophilic attack

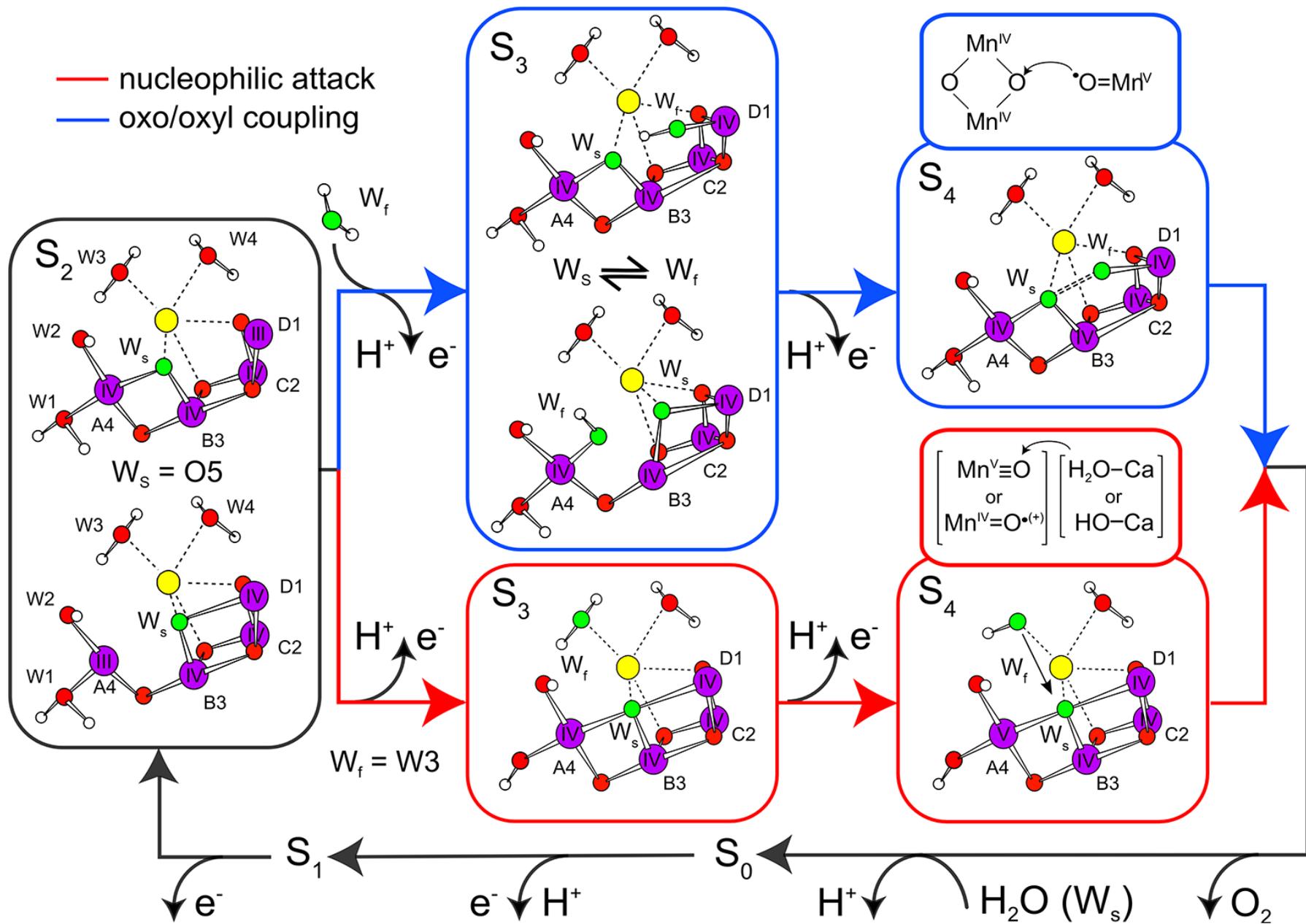


$\text{Mn(V)}\equiv\text{O}$ o $\text{Mn(IV)}=\text{O}\cdot$

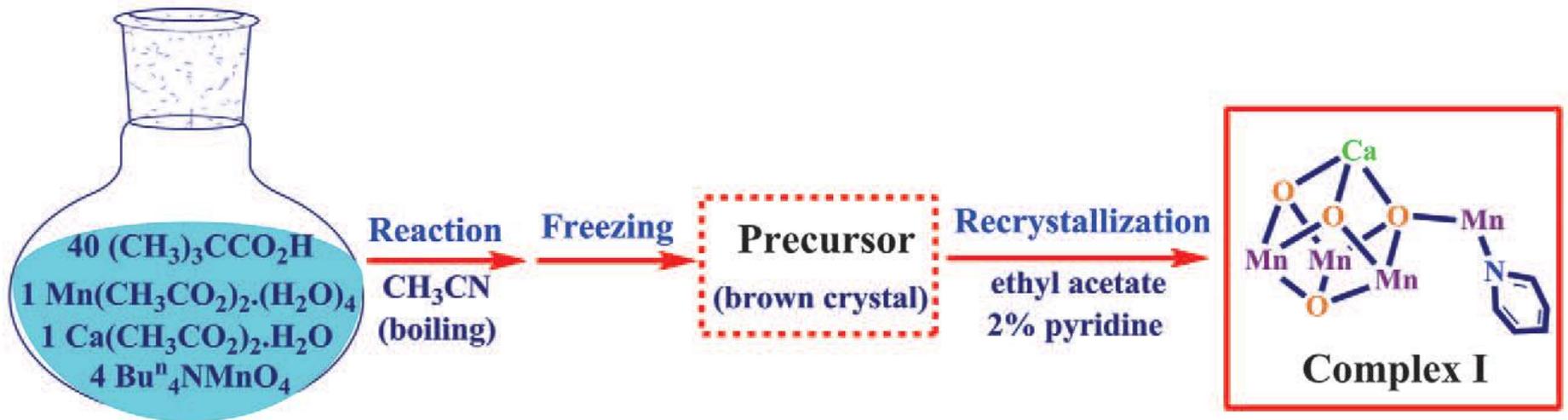
terminal oxyl radical
with bridging oxo



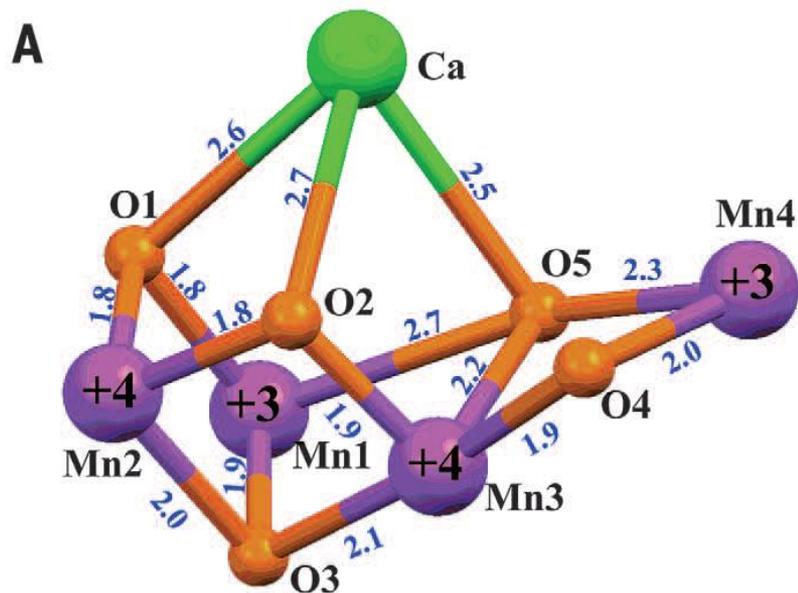
oxo/oxyl radical coupling mechanism



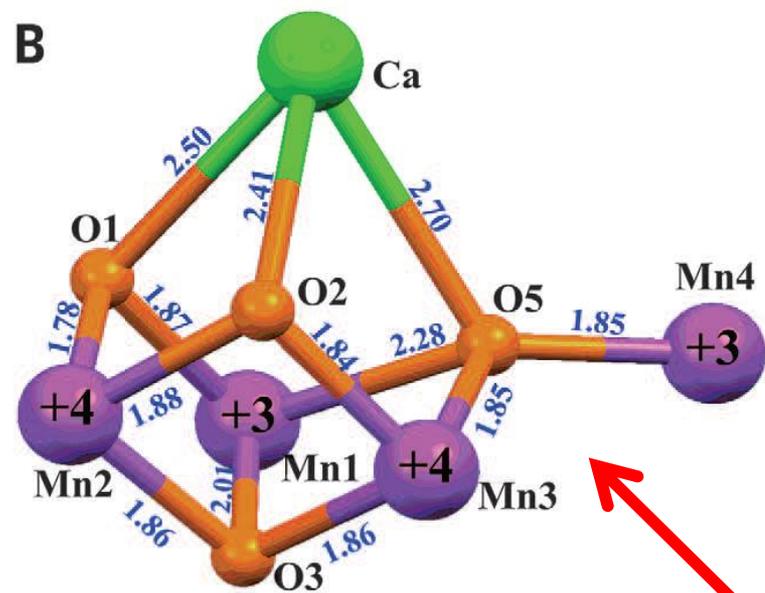
Sistemi modello



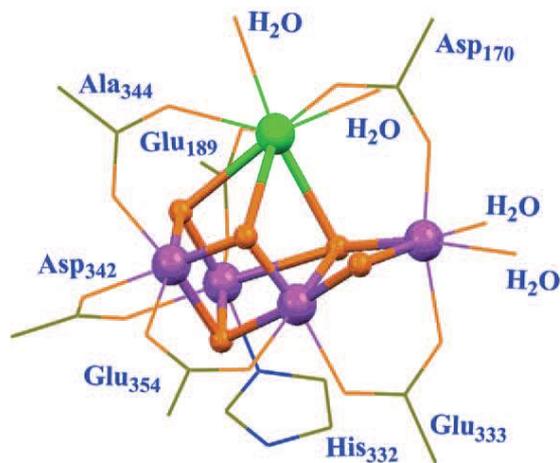
Natural catalyst



Artificial complex



C



D

