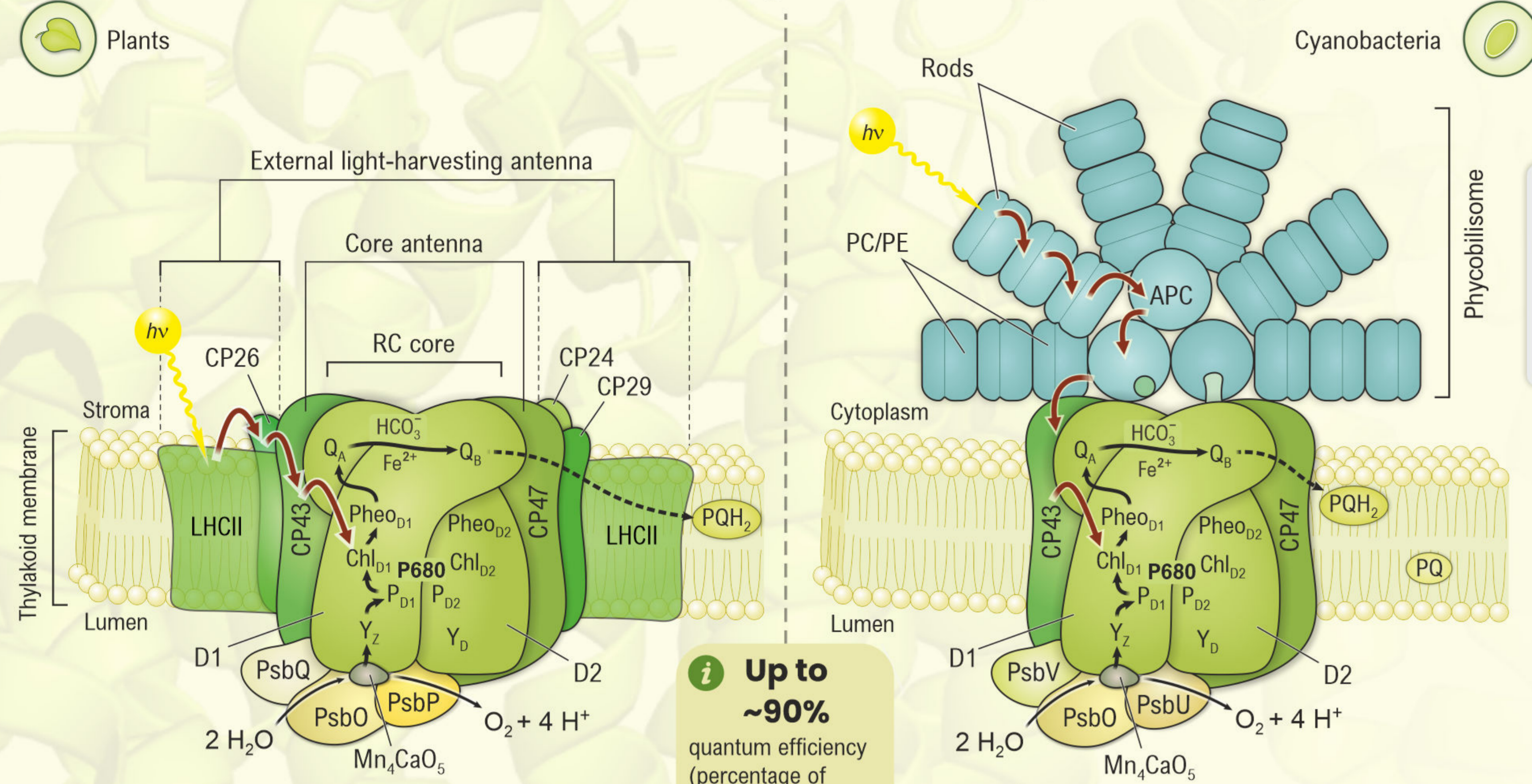


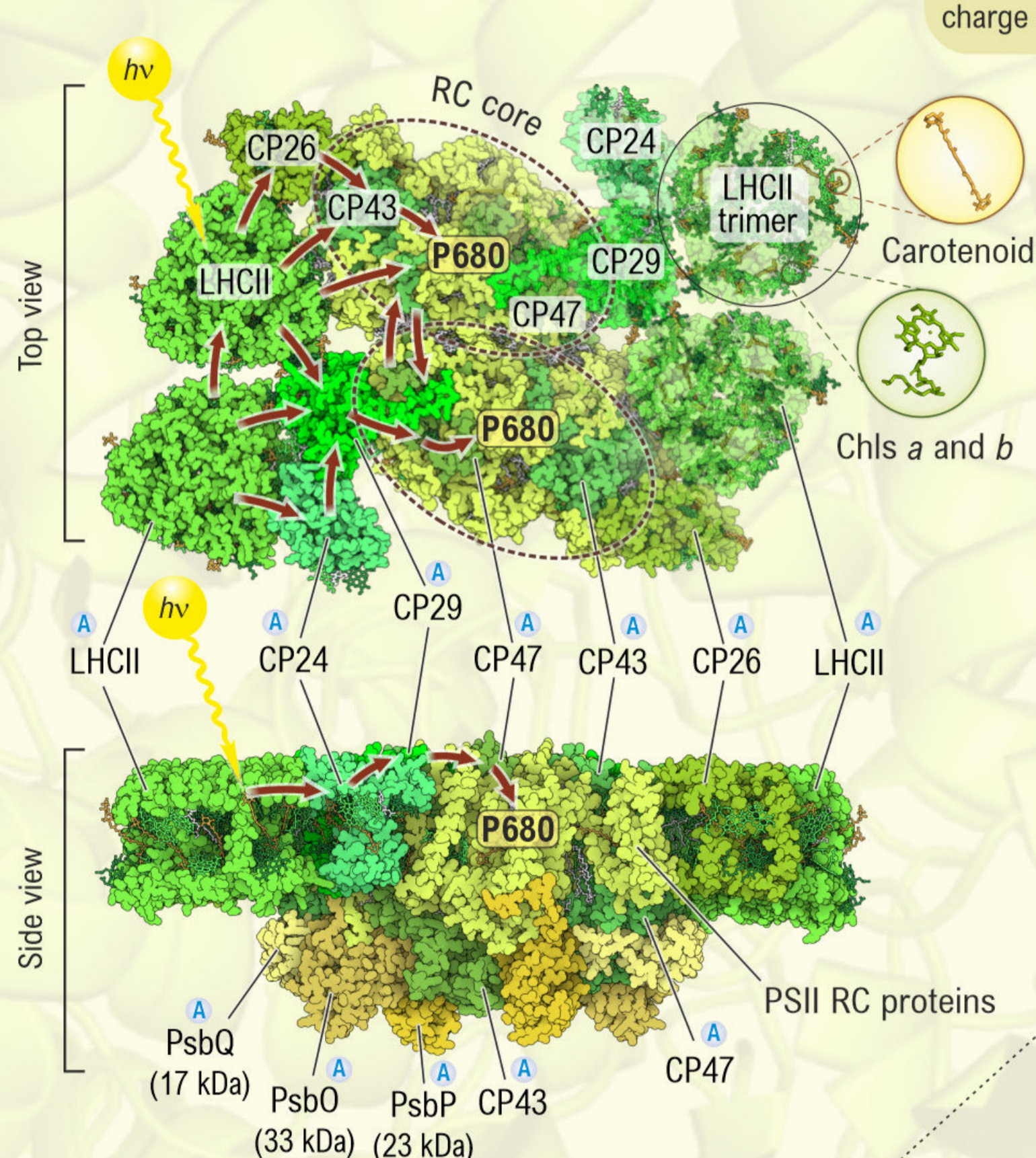
Photosystem II: Enzyme That Gives Us Molecular Oxygen

PSII Reaction Centers & PSII Light-Harvesting Antenna Systems

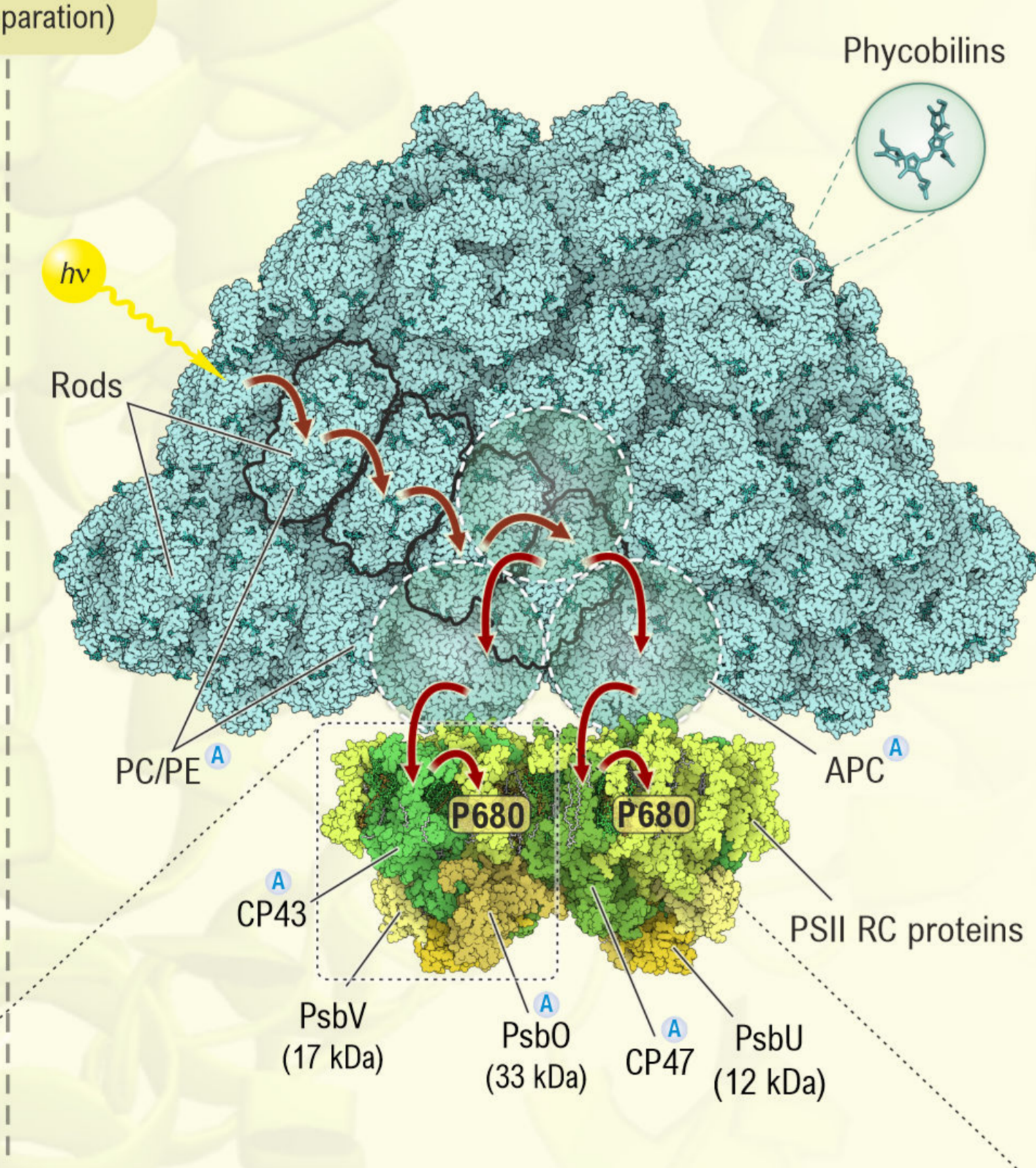


Up to ~90% quantum efficiency (percentage of absorbed photons that are trapped by PSII and promote charge separation)

C2S2M2-type PSII-LHCII supercomplex



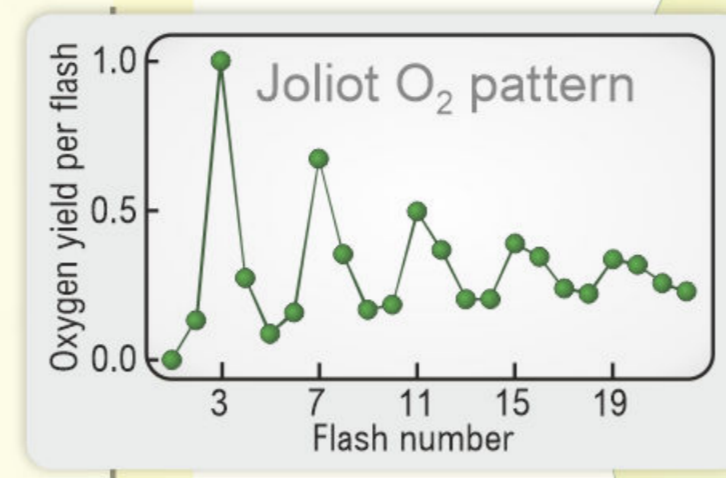
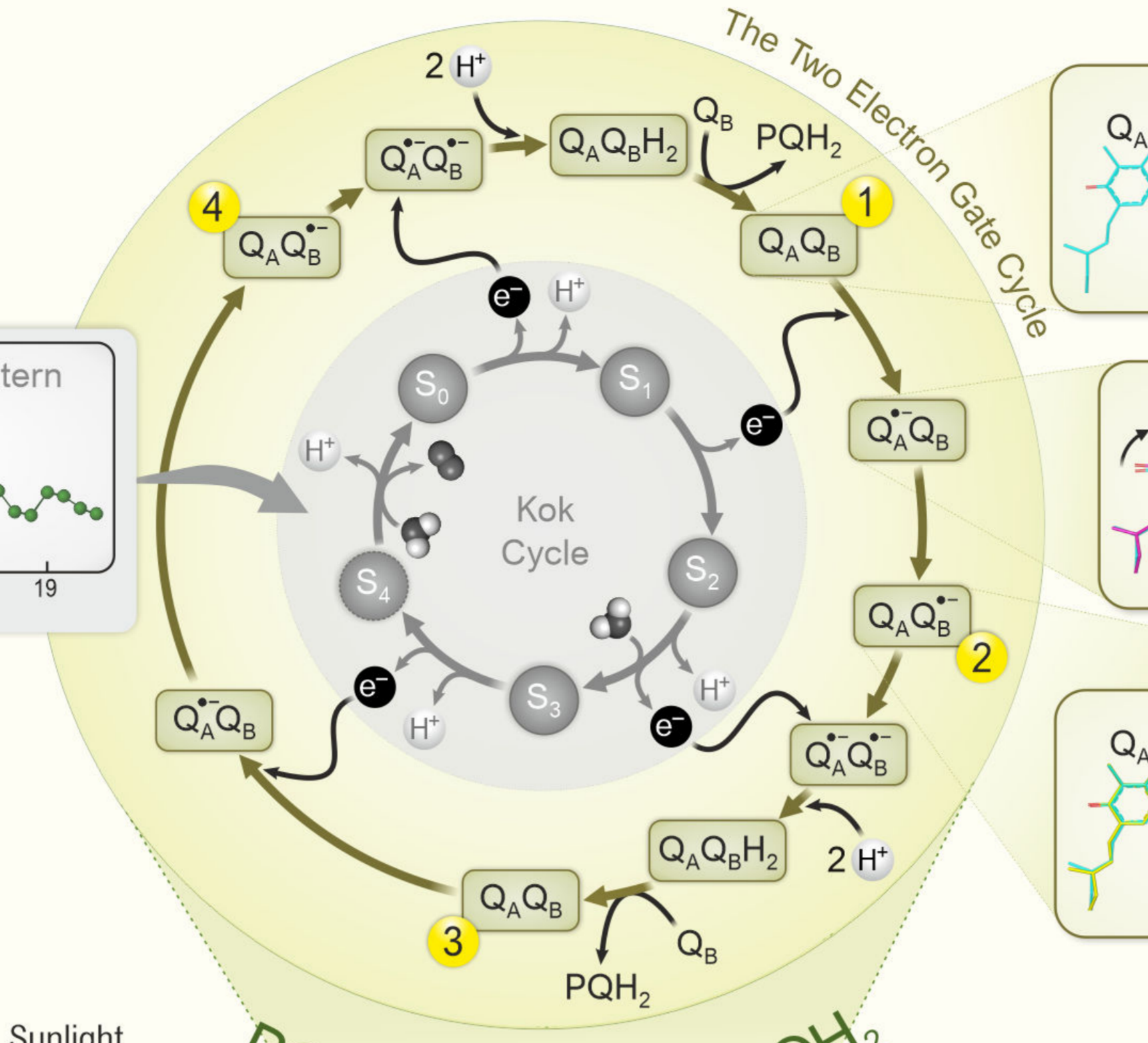
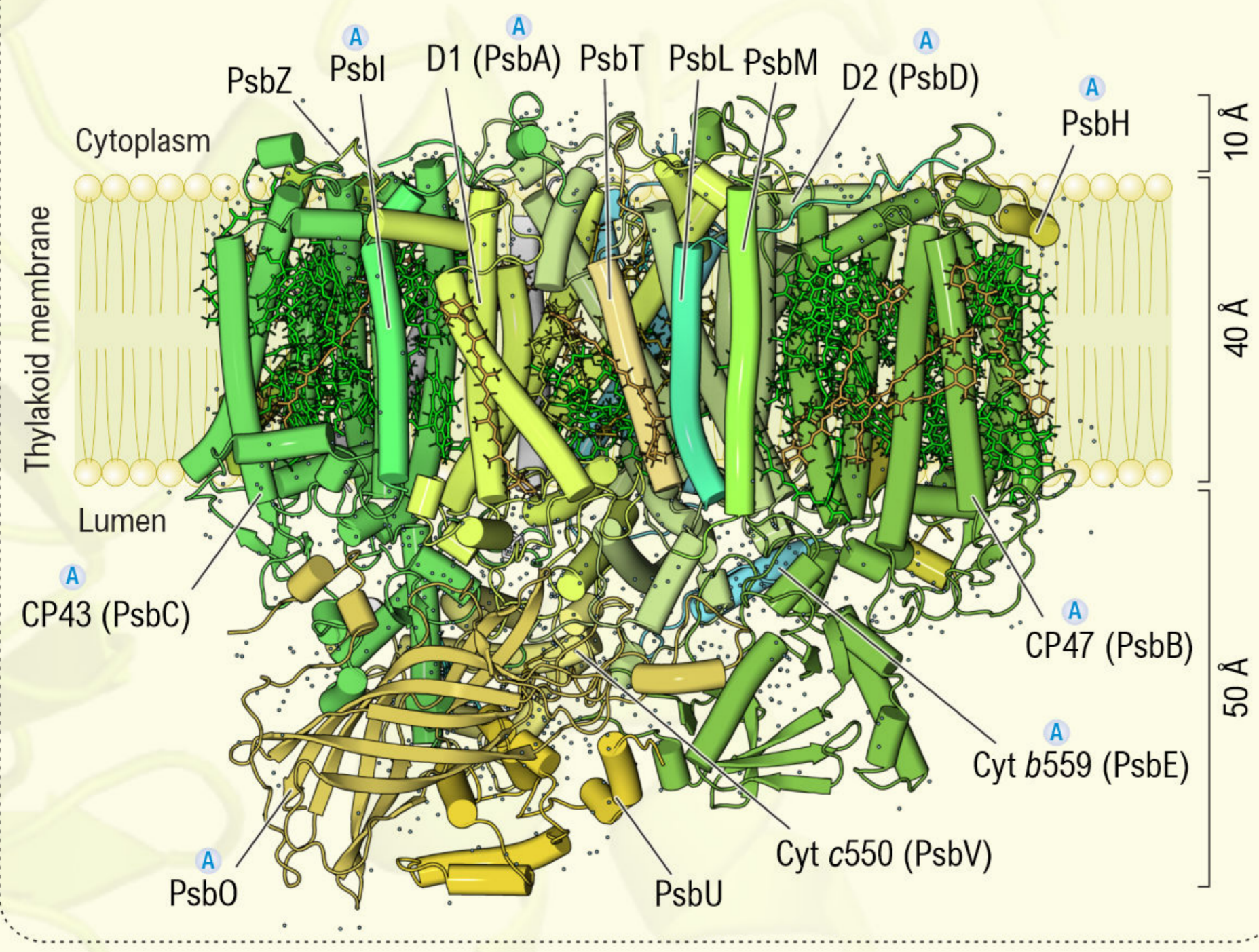
PSII dimer with phycobilisomes



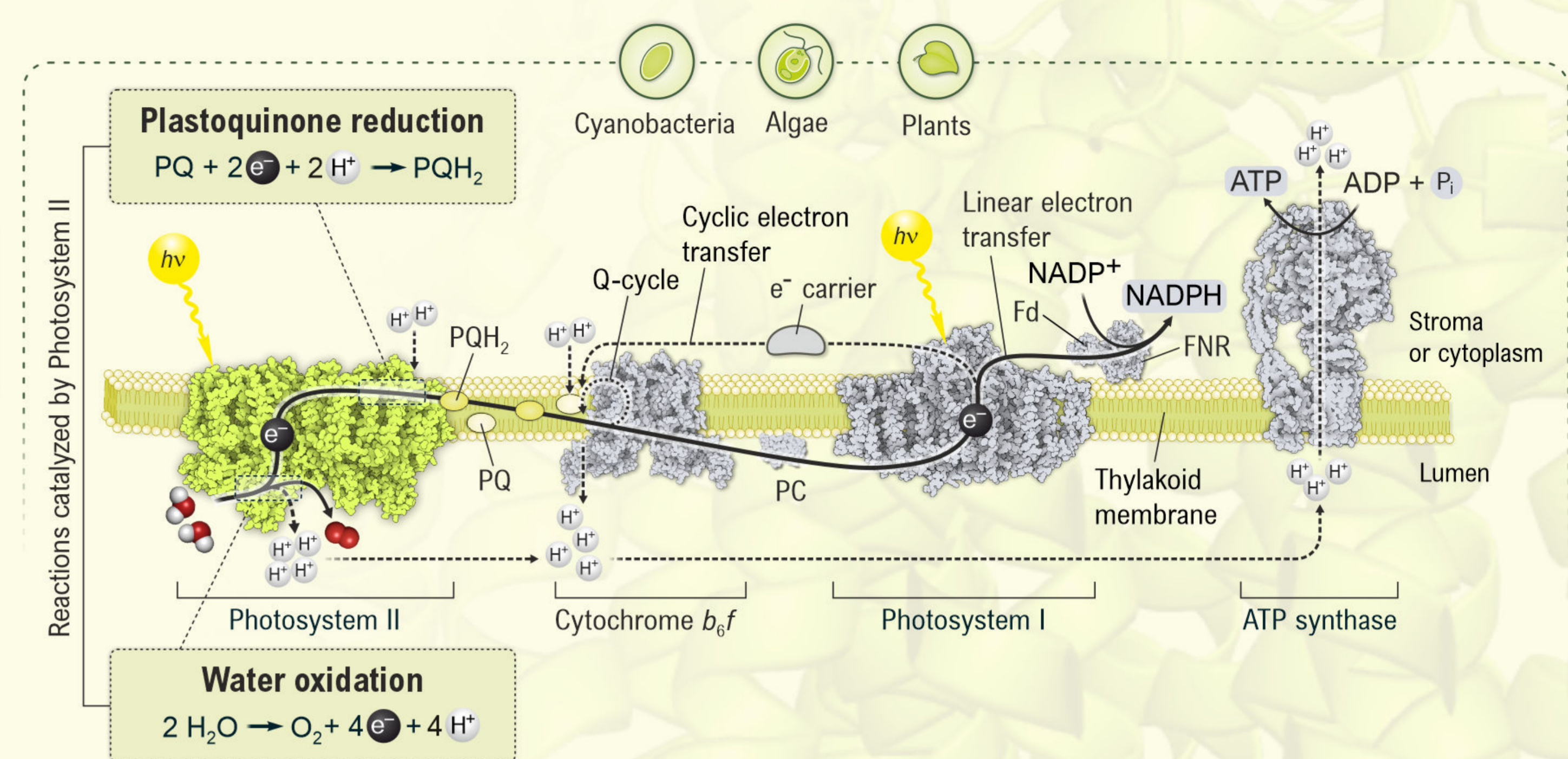
Each PSII monomer consists of **>20 subunits** and **~100 cofactors**. Under full sunlight PSII needs to be repaired **every 30 min**.

- Symbols**
- Antibodies provided by Agrisera
 - Bridging oxygen atoms
 - Molecular oxygen
 - Metal bound water molecules (W1-W4)
 - Other water molecules
 - Light flash number
 - Electron
 - Proton
 - Suggested water/proton channels
 - Excitation energy transfer
 - Electron transfer
 - Molecular movement
 - Oxidizing equivalent

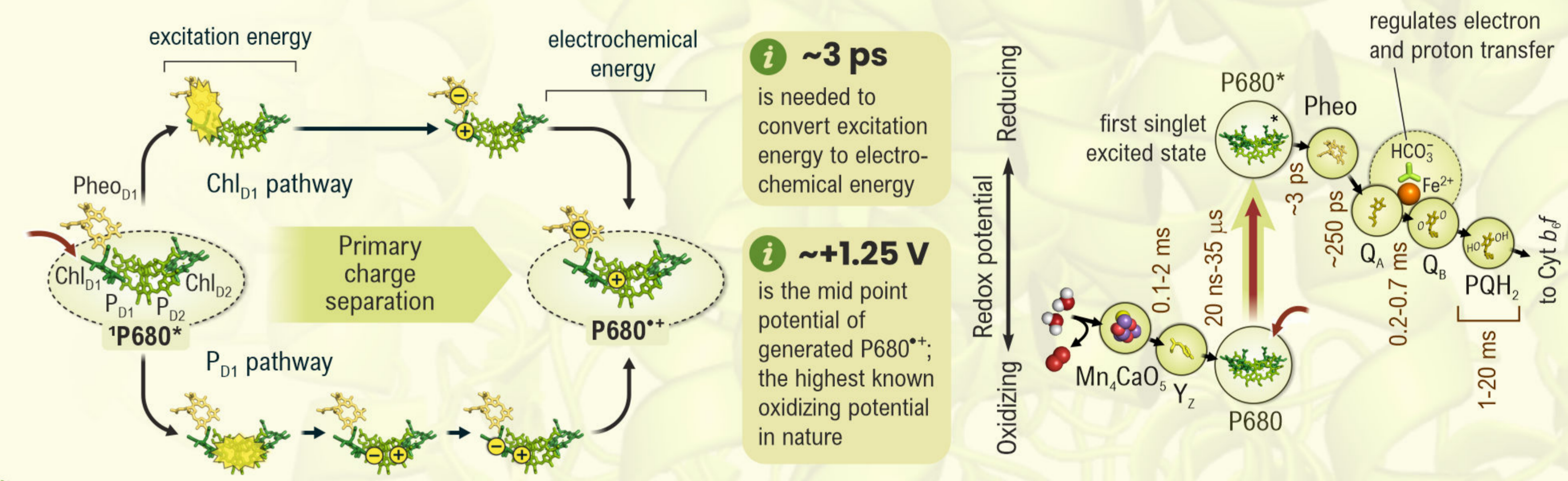
Cyanobacterial PSII monomer



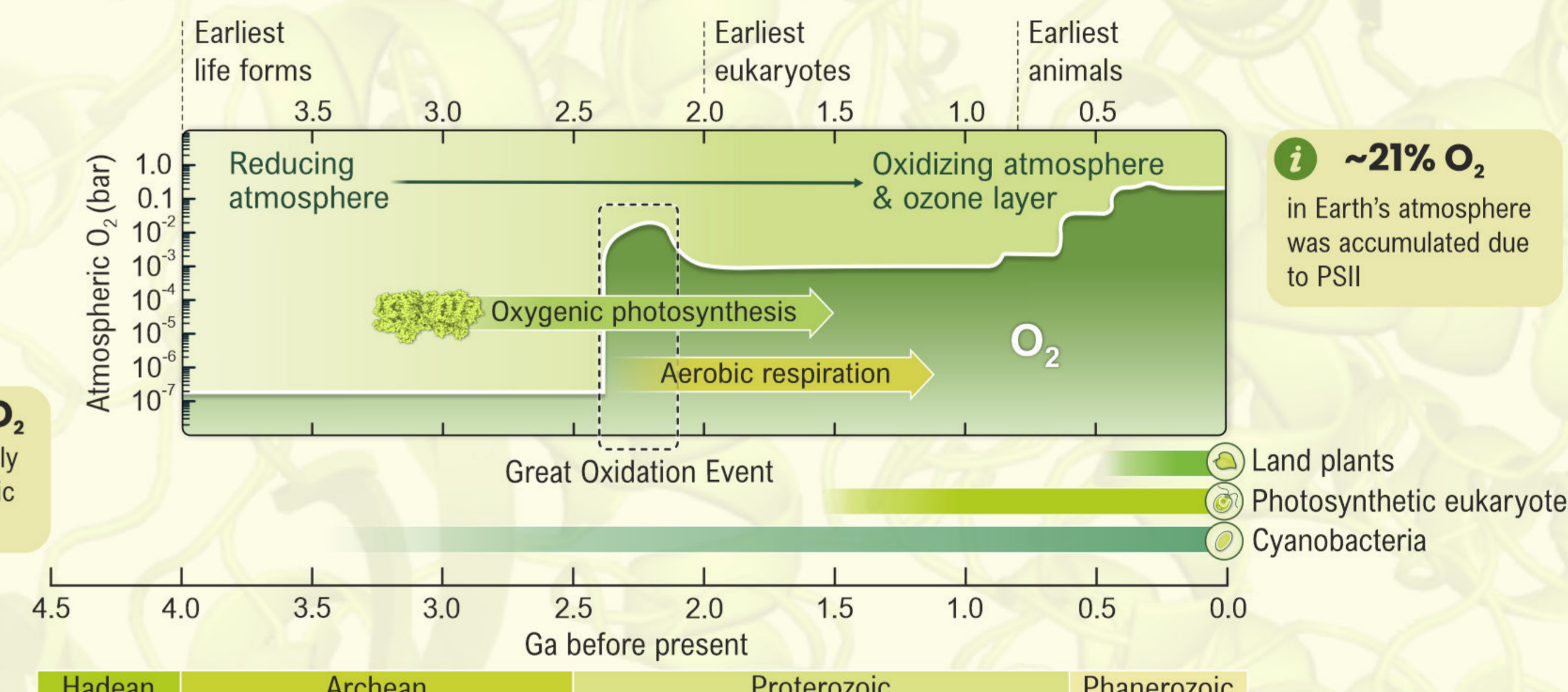
Reactions catalyzed by Photosystem II



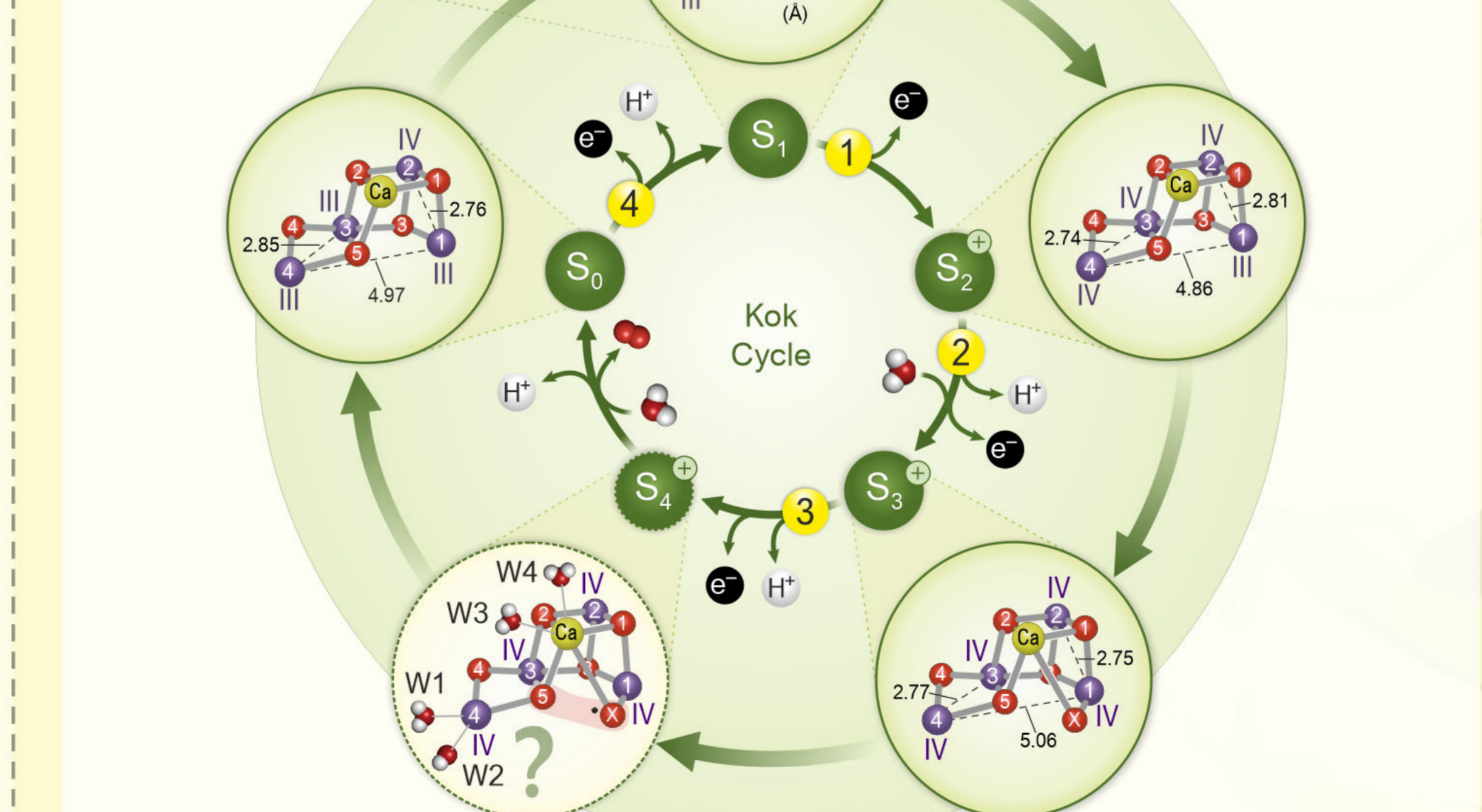
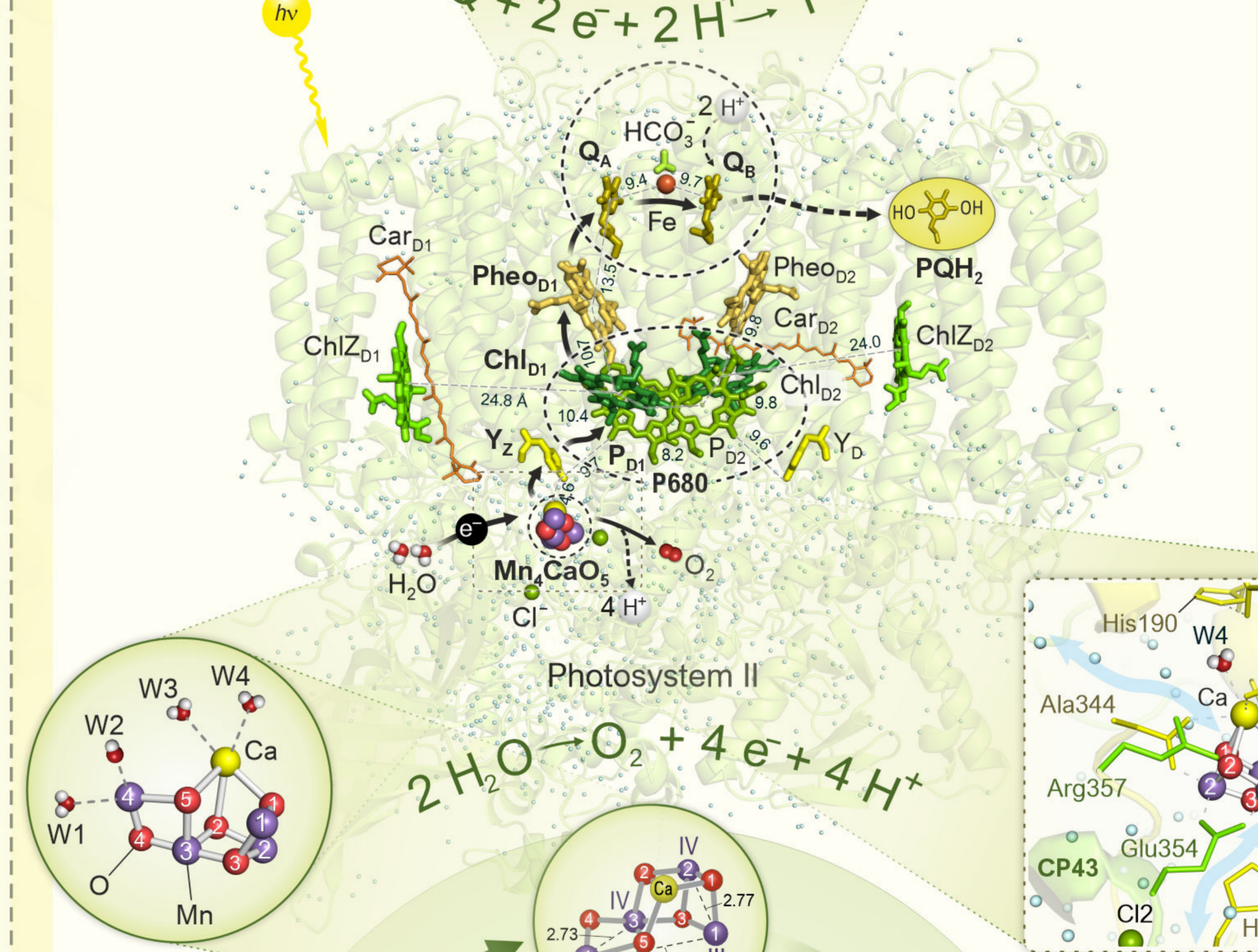
Conversion of Light Energy to Chemical Energy



Impact of Photosystem II on Earth's Atmosphere and Life



~21% O2 in Earth's atmosphere was accumulated due to PSII. **~280 Gt O2** is released annually by PSII of oxygenic organisms.



Up to ~50 O2 are released per second (turnover frequency). **~100 000 O2** can be produced before PSII needs to be repaired (turnover number).

Photosystem II Poster: Structure and function of the enzyme Photosystem II (PSII; water:plastoquinone oxidoreductase; EC 1.10.3.9). For further information, see [1-9] and refs therein. Send questions and comments to G. Govindjee (gov@illinois.edu) and/or to D. Shevela (dmitry@sheveladesign.se). **Abbreviations:** ADP, adenosine diphosphate; APC, allophycocyanin; ATP, adenosine triphosphate; Cyt b6/f, cytochrome b6/f complex; Fd, ferredoxin; FNR, ferredoxin-NADP reductase; Mn,CaO5, manganese-calcium-oxygen complex; NADP+/NADPH, nicotinamide adenine dinucleotide phosphate (oxidized/reduced forms); PE/PC, phycoerythrin/phycoerythrin; Pheo, pheophytin of which PheoD1 is the primary electron acceptor of PSII; PQ/PQH2, mobile plastoquinone molecules (oxidized/reduced forms); P680, primary electron donor of PSII that includes the chlorophyll (Chl) a molecules P680, P680, ChlD1, and ChlD2; QA and QB, primary and secondary plastoquinone electron acceptors; RC, reaction center; Y3/Y2, redox-active tyrosines D/Z. **Notes:** Complexes and cofactors were generated with PyMOL and Protein Imager software using coordinates of the following PDB codes: 1AG6, 1VF5, 2MH7, 3ARC, 3W5U, 4Y28, 5XNL, 6B8H, 6KXG, 6W10, 6W1R, and 6W1P. Phytol tails of Chls and Pheo, and the isoprenyl chains of the quinones are not shown. **Acknowledgements:** We thank Jian-Ren Shen, Holger Dau, Robert Blankenship, and Elisabet Romero for their valuable comments and corrections. We are highly grateful to Agrisera for sponsoring the poster design, printing, and free distribution at conferences around the world. **Citation:** Shevela D, Kern J, Whitmarsh J, Messinger J, Govindjee G (2021) Photosystem II: Enzyme that gives us molecular oxygen. *Agrisera Educational Poster 5*. doi:10.6084/m9.figshare.14802924

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Poster 5 - Photosystem II, 2021

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