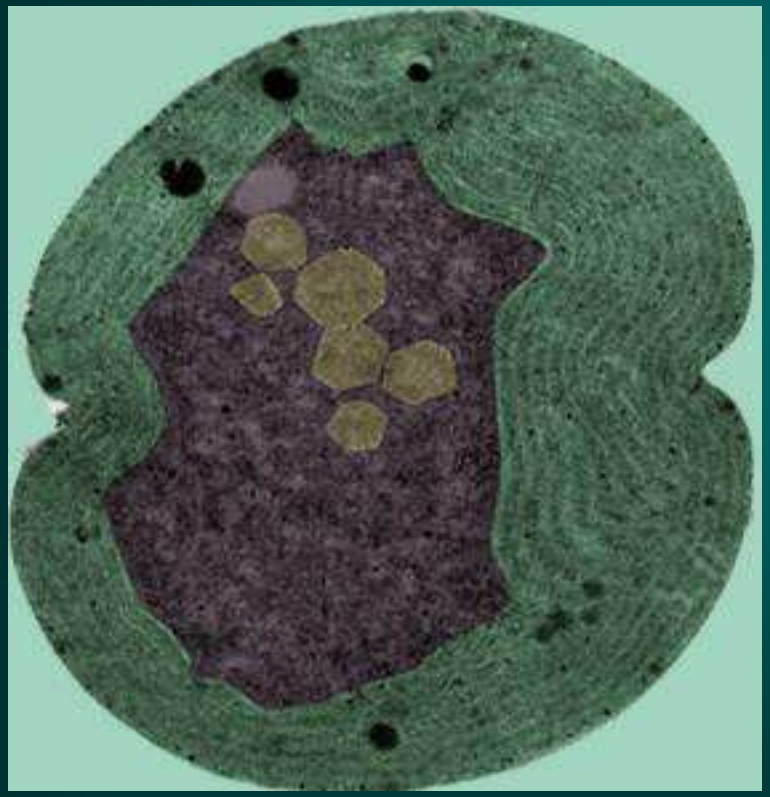
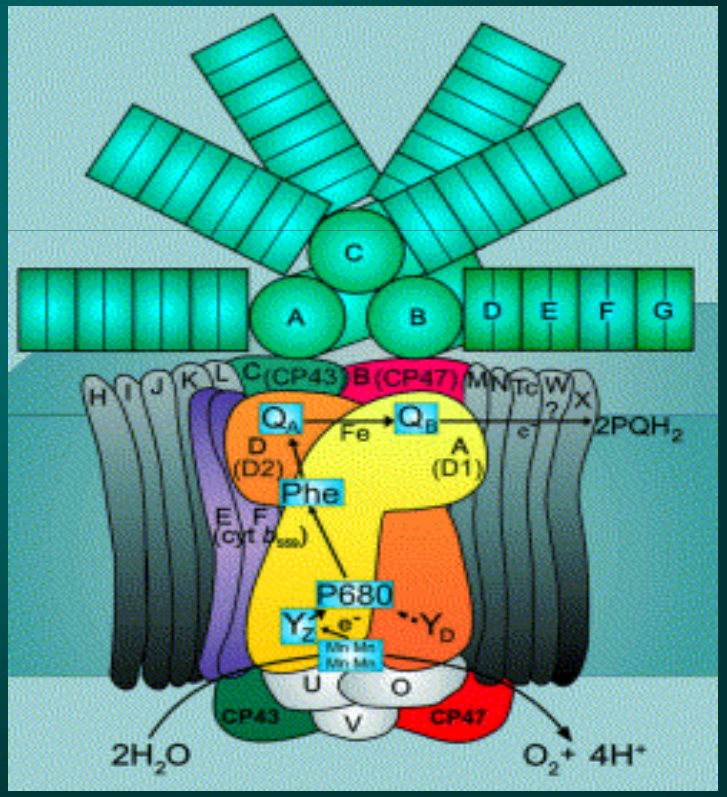
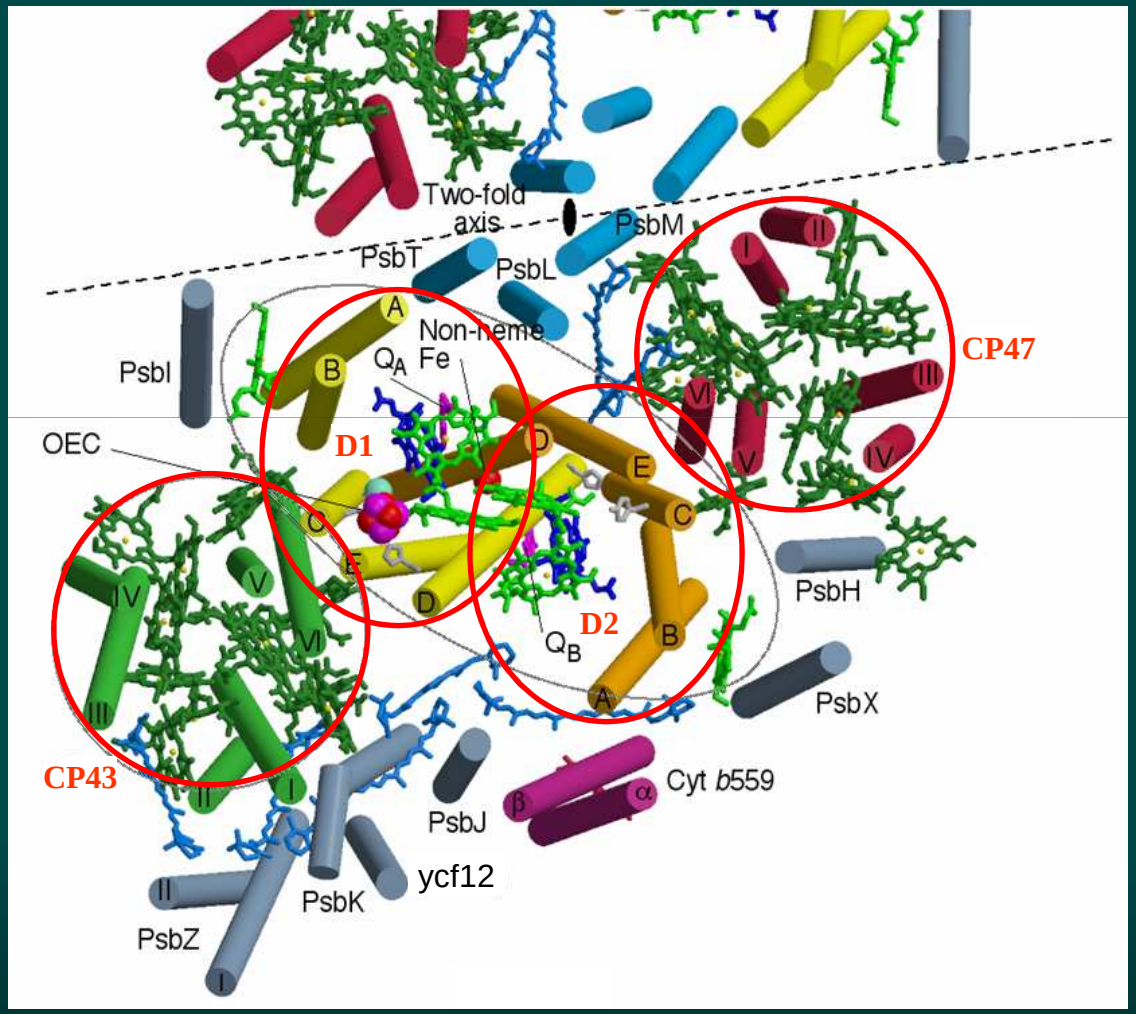
The role of small subunits in biogenesis of the cyanobacterial Photosystem II



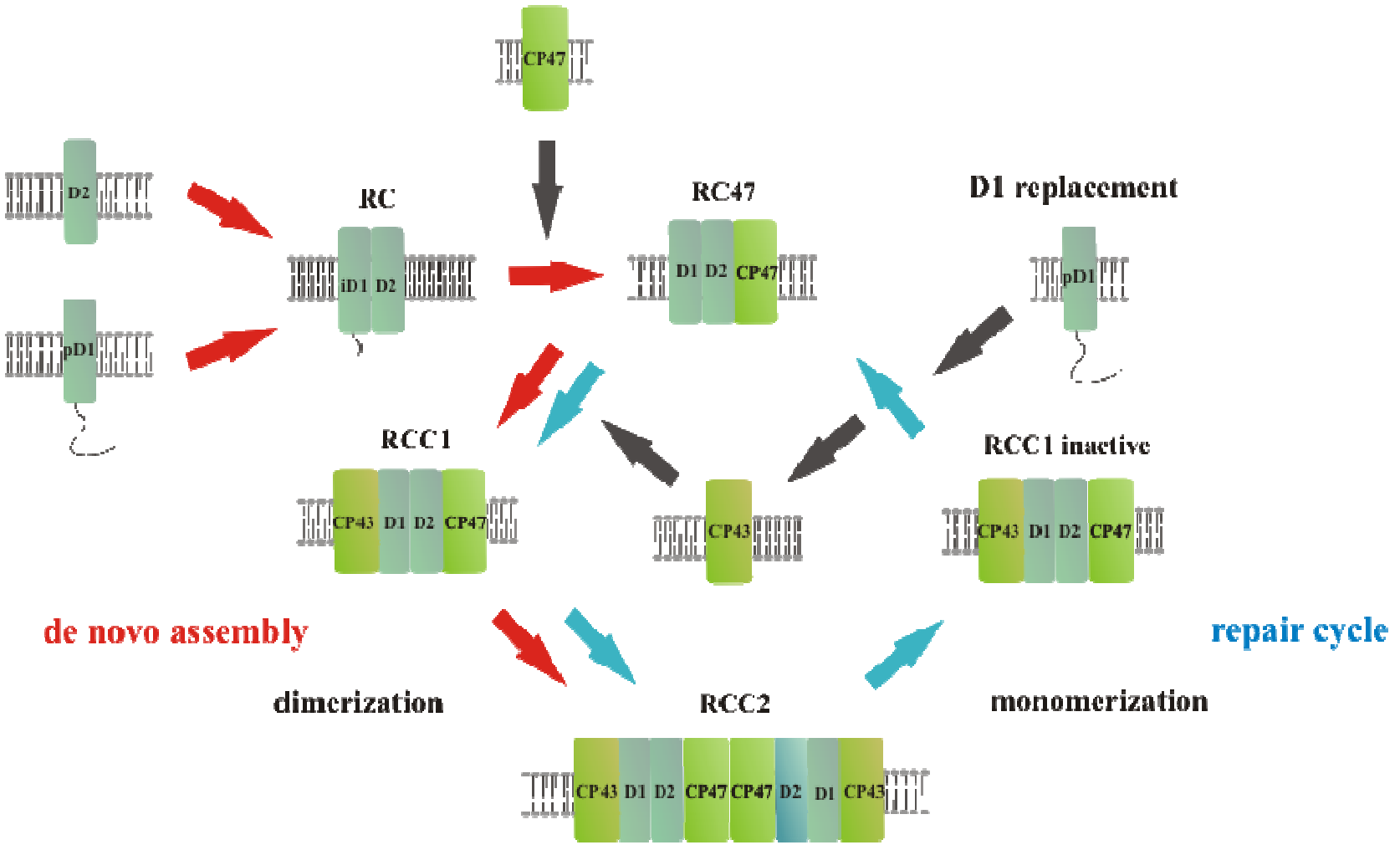


Cyanobacterial photosystem II is a sophisticated molecular machine producing oxygen and electrons and containing a dozen of protein subunits. The largest ones are D1, D2, CP47 and CP43, all of them bind chlorophyll

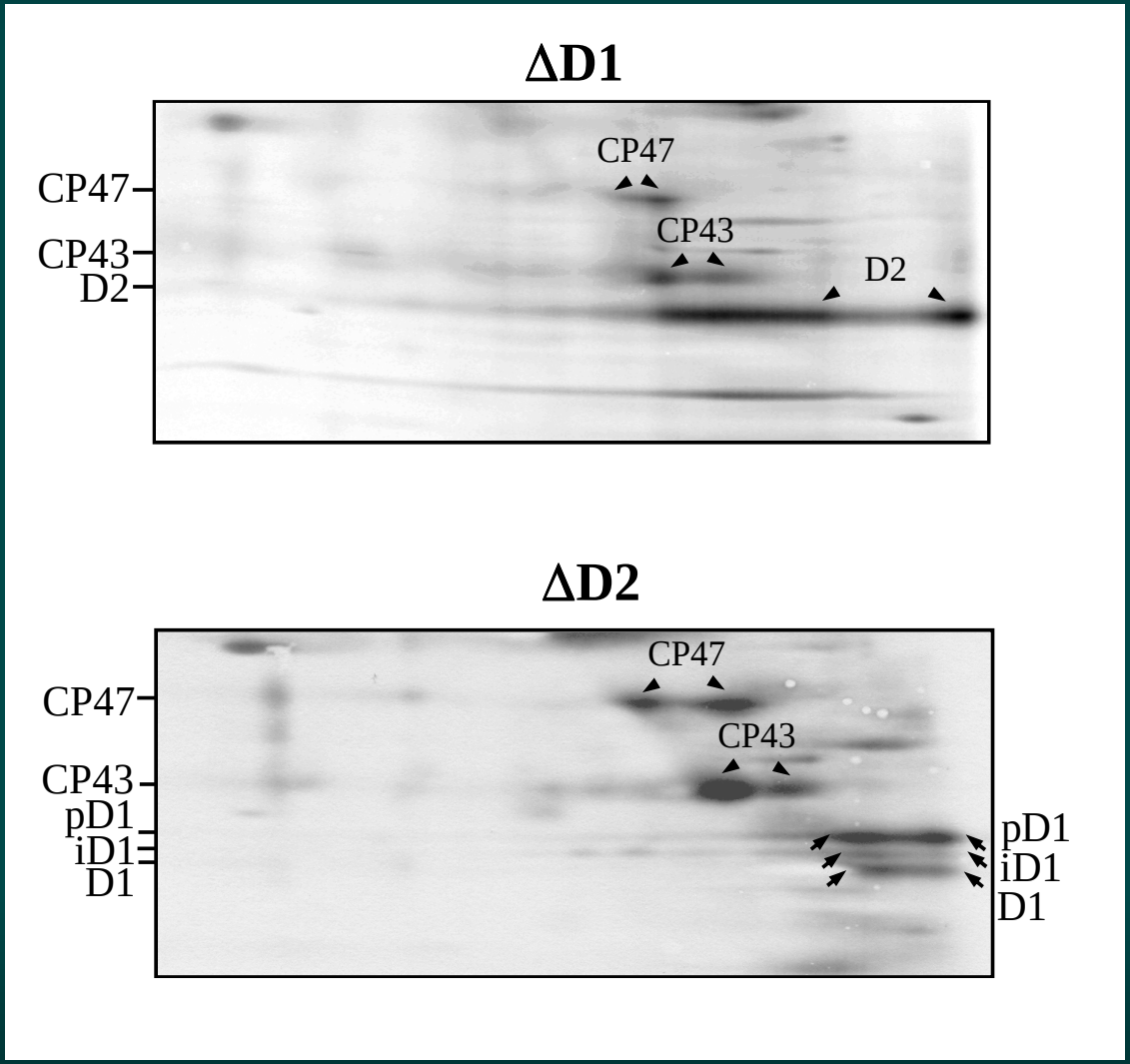


modified from Ferreira et al., Science 2004

Assembly of large PSII proteins occurs in the order (D2+D1)+CP47+CP43



Unassembled forms of all four large PSII subunits (especially in certain mutants) occur on 2D gels as double bands; do the larger bands represent complexes with small subunits?



modified from Komenda et al., J Biol Chem 2004

The role of cytochrome b-559 in the PSII assembly

In the early phase of PSII biogenesis the cytochrome b-559 associates with D2 but occurs also as unassembled heterodimer, most probably in thylakoids

In the absence of cytochrome the synthesis of D2 is very limited (the CES mechanism cannot be excluded) and the newly synthesized protein is quickly degraded

Without cytochrome b-559 the accumulation of the unassembled D2 is not affected by removal of thylakoid FtsH (slr0228) protease while when cytochrome b-559 is present accumulation of D2 is strongly increased in the absence of FtsH (slr0228)

The role of PsbI in the PSII assembly

In the early phase of PSII biogenesis the PsbI protein associates with D1; it also occurs as the unassembled subunit most probably in thylakoids since in the absence of D1 the level of unassembled PsbI is increased after removal of the thylakoid FtsH (slr0228)

In the absence of PsbI the availability of D1 for assembly of new PSII complexes is limited and binding of CP43 to the rest of PSII is destabilized

PsbI is a component of RC complexes but it is not essential for their assembly

The role of PsbK in the PSII assembly

The PsbK protein associates with CP43 before this chlorophyll-protein binds to PSII, PsbK significantly contributes to the formation of the slower CP43 band detectable on 2D gels

In the absence of PsbK the binding of CP43 to the rest of PSII is destabilized

Role of PsbH in the PSII biogenesis

The PsbH subunit is bound to the middle part of CP47 before CP47 associates with the D1-D2 heterodimer to form RC47. Amount of PsbH is nearly stoichiometric to CP47

In the absence of PsbH the binding of CP47 to the D1-D2 heterodimer is destabilized. In the strain lacking D2 deletion of PsbH leads to the decreased synthesis of CP47 but synthesis of CP43 is also affected indicating connection between synthesis of both proteins

The subunit PsbH is required for binding of Scps (Hlips) allowing their protective function to be exerted.

There are five genes in the genome of *Synechocystis sp*. PCC 6803 with a sequence homology to the 1st and 3rd helix of LHCII encoded by cab genes (Scps). Synthesis of four of the is induced under high light conditions (HLIPs)

scpA, scpB, scpC, scpD, scpE

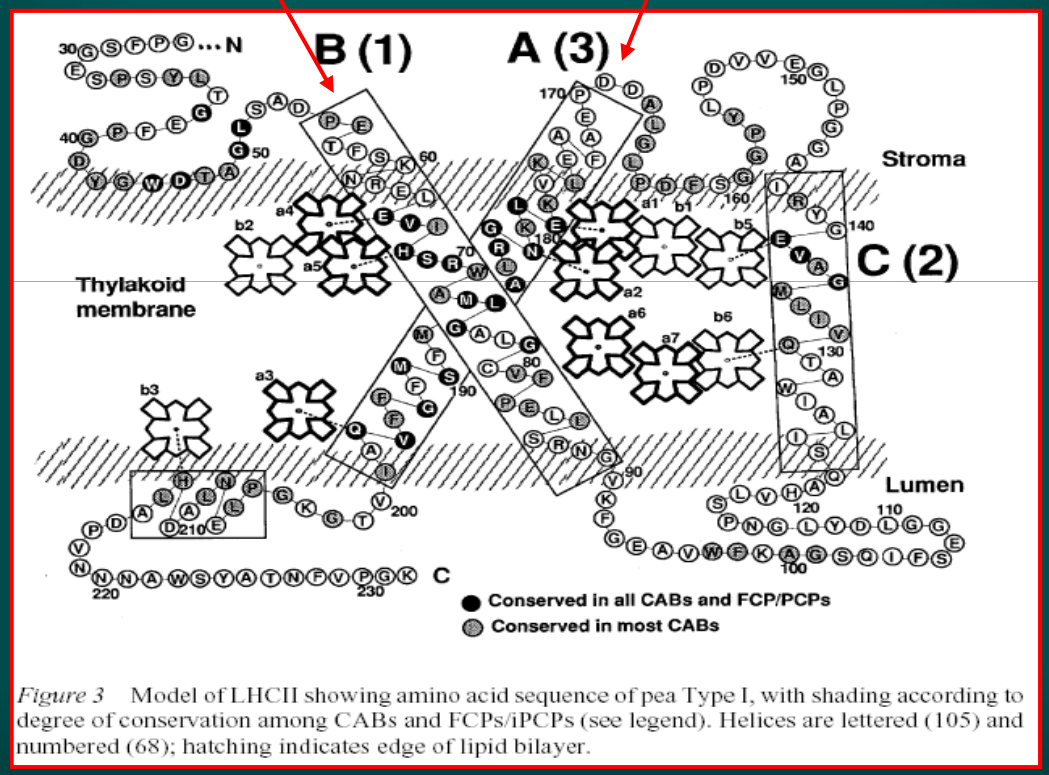


Figure 3 Model of LHCII showing amino acid sequence of pea Type I, with shading according to degree of conservation among CABs and FCPs/iPCPs (see legend). Helices are lettered (105) and numbered (68); hatching indicates edge of lipid bilayer.

Scps (Hlips) protect PSII subunits and other thylakoid proteins against the oxidative damage under extreme stress conditions, we hypothesize that they scavenge released chlorophyll molecules

Life cycle of Photosystem II in *Synechocystis*