How plants bind their green pigment chlorophyll

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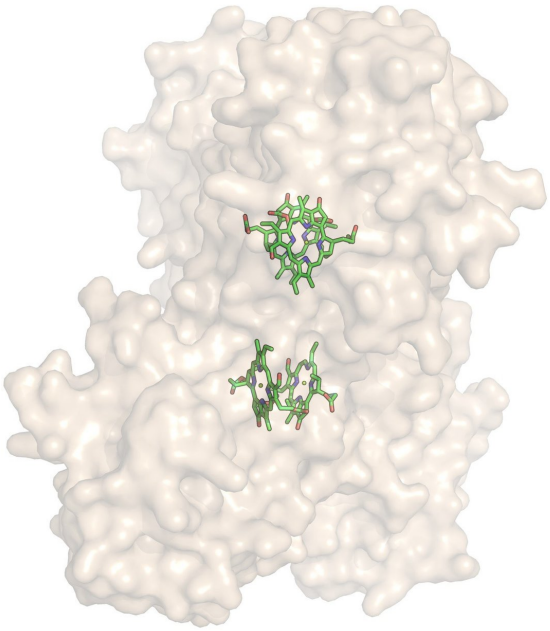

Water-soluble Chlorophyll Protein tetramer binding four chlorophylls (in green). Credit: Alessandro Agostini, JGU

Chlorophyll is the pigment used by all plants for photosynthesis. There are two versions, chlorophyll a and chlorophyll b. These are structurally very similar to one another but have different colors, blue-green and yellowish green, respectively. Both pigments fulfill different jobs during photosynthesis and are therefore bound very selectively by the proteins of the photosynthesis apparatus in plants. But it is still unknown how these plant proteins recognize the two chlorophylls and thus bind them selectively.

Researchers of Johannes Gutenberg University Mainz (JGU), together with two Japanese colleagues, have partially solved this riddle. The team of Professor Harald Paulsen at the JGU Faculty of Biology used the so-called water-soluble chlorophyll protein of cauliflower and Virginia pepperweed as a model protein. This protein possesses only a single chlorophyll binding site per protein molecule, and is able to bind both chlorophyll versions. Upon variation of the amino acids near the chlorophyll binding site, the preference of the protein for one chlorophyll or the other changed. In one case, exchanging a single amino acid altered the relative binding strengths by a factor of 40. "This does not explain everything about Chl a/b binding specificity in the photosynthetic apparatus," said Paulsen, "but our results yield useful hypotheses that now can be tested with photosynthesis proteins. In the longer run, this may help to improve light harvesting in new photovoltaic devices or in artificial photosynthesis."

One of the lead authors of the publication in *Nature Plants* is Dr. Alessandro Agostini. He received his doctorate for his thesis on water-soluble chlorophyll protein jointly from Mainz University (Paulsen group) and the University of Padova in Italy (group of Professor Donatella Carbonera). "This is a nice example of a successful international collaboration," added Paulsen, "not only in terms of research but also by jointly advising a graduate student." This work was funded by the German Research Foundation.

More information: Daniel M. Palm et al, Chlorophyll a/b binding-specificity in water-soluble chlorophyll protein, *Nature Plants* (2018). DOI: 10.1038/s41477-018-0273-z

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