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Plant Rubisco maturation requires a specific aminopeptidase

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During the oxygenic photosynthesis in plants, algae and cyanobacteria, atmospheric carbon dioxide (CO2) is assimilated into carbohydrates making photosynthetic organisms autotrophic. Rubisco catalyzes this step of carbon dioxide and oxygen uptake. Interestingly, the catalytic subunit of Rubisco (RbcL) undergoes a unique maturation pathway leading to unique N-terminal modifications. This mechanism is conserved in plants, and results in the formation of an N-terminal acetylated Pro3. Which protease(s) are in charge of N-terminal cleavage(s) is unknown so far, as is the impact of this maturation on Rubisco. Here, we present conserved aminopeptidase (AtAMPP and AtAARE) with in vitro experiments from the purified proteins and ad hoc knockout Arabidopsis plant lines. We show that AtAMPP is in charge of residue 2 release, while AtAARE is not involved neither in RbcL maturation or in any N-terminal protein maturation of the plastid. Next, we have established conditions that allow the production of a range of RbcL N-terminal variants in the presence or absence of the identified enzymes involved in its N-terminal maturation. Together, my data deal with a comprehensive characterization of the unique N-terminal Ser2 excision in RbcL processing.

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