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Structure characterization of the *Chlamydomonas reinhardtii* magnesium chelatase GUN4 and H subunits by small-angle X-ray scattering

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The magnesium chelatase enzyme catalyses the ATP dependent insertion of Mg^{2+} into protoporphyrin IX (PPIX) in the first step of the chlorophyll biosynthesis pathway consists three different protein subunits ChlI, ChlD and ChlH. The GUN4 protein is a regulatory subunit of Mg-chelatase that binds the chlorophyll biosynthesis intermediates, PPIX and Mg protoporphyrin (Mg-PPIX), stimulates Mg chelatase activity, and is implicated in developmental signaling pathway between the chloroplast and nucleus. ChlH is the largest subunit of Mg-chelatase which also binds both PPIX substrate and the Mg-PPIX product. GUN4 appears to participate in a plastid-to-nucleus signalling pathway possibly through regulating Mg-PPIX synthesis or trafficking. Unlike the cyanobacterial GUN4, the chloroplastic orthologous have an extra C-terminal domain that is phosphorylated and is required for magnesium chelatase activity. We have determined the low resolution solution structure of GUN4, H and the GUN4-H-PPIX complex at $\sim 20 \text{ \AA}$, by using (SAXS) small-angle x-ray scattering and can report that the GUN4 protein has a more elongated structure compared to the cyanobacterial protein. Furthermore, The SAXS structure of the GUN4-H-PPIX complex is similar to the SAXS structure of H subunit suggesting that GUN4-PPIX may attach somewhere inside the cage shape structure of H subunit to form a complex.

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