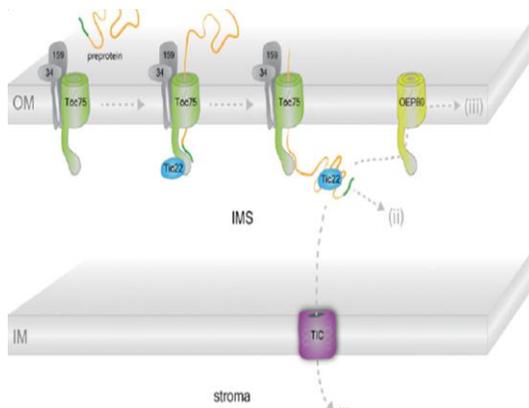


## The POTRA domains of Toc75 exhibit chaperone-like function to facilitate import into chloroplasts



Chloroplasts, like mitochondria, are organelles of endosymbiotic origin, having evolved from initial engulfment of a cyanobacterium by a eukaryotic cell. Most of the bacterial genome was subsequently lost so that most proteins found within chloroplasts are synthesized in the cytoplasm as preproteins and then imported via specialized machinery prior to trafficking to their final destination. Protein import is accomplished by the TOC (translocon on the outer chloroplast membrane) and TIC (translocon on the inner chloroplast membrane) machineries in the outer

and inner envelope membranes, respectively. The TOC complex includes a protein called Toc75, which serves as the translocation channel along with two other proteins, as well as Toc33 and Toc159, which both contain GTPase domains, which help drive substrate selection and importation. Structural information for the TOC complex was hitherto lacking, hindering the ability of investigators to form mechanistic models for function. Here a team lead by Nicholas Noinaj (Purdue University) and Danny Schnell (Michigan State University) reported crystal structures of Toc75 consisting of three tandem POTRA domains. High quality size exclusion chromatography –SAXS experiments at the BioCAT Beamline 18ID were important in establishing that crystal structures accurately represented protein structure in solution. The POTRA domains may help facilitate preprotein import by directly binding preproteins and orchestrating handoff to the TIC complex. Their results support a model in which the POTRA domains act to bind and chaperone preproteins as they emerge from the TOC channel into the IMS, and function in conjunction with the IMS chaperone Tic22 to prevent precursor misfolding or aggregation during protein import. The data, therefore, suggest a model in which the POTRA domains serve as a binding site for the preprotein as it emerges from the Toc75 channel and provide a chaperone-like activity to prevent misfolding or aggregation as the preprotein traverses the intermembrane space.

See: Patrick K. O’Neil<sup>ab</sup>, Lynn G. L. Richardson<sup>c</sup>, Yamuna D. Paila<sup>c</sup>, Grzegorz Piszczek<sup>d</sup>, Srinivas Chakravarthy<sup>e</sup>, Nicholas Noinaj<sup>ia,b</sup>, and Danny Schnell<sup>c</sup> Proc Natl Acad Sci U S A. 2017 Jun 13;114(24):E4868-E4876.

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