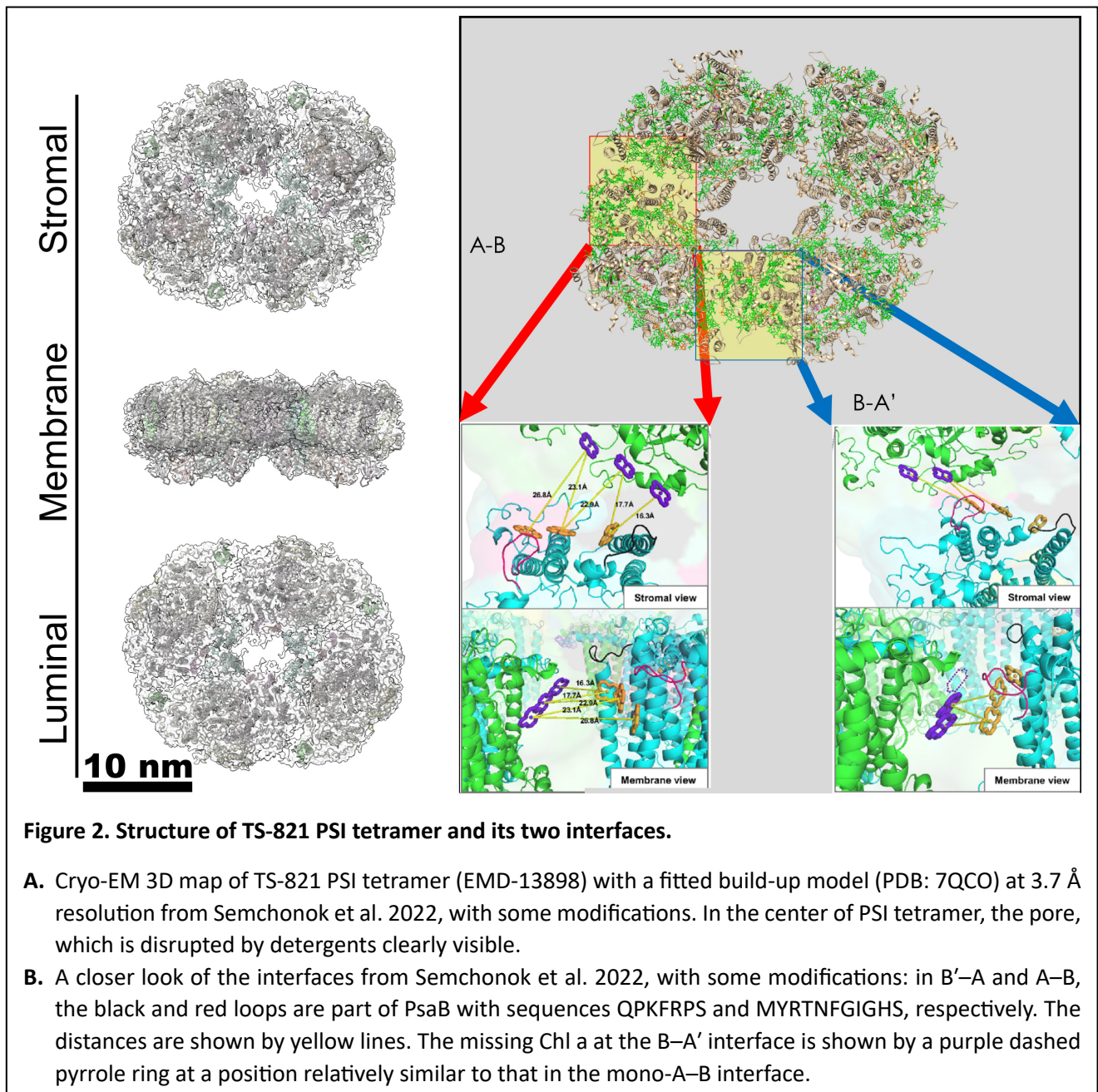
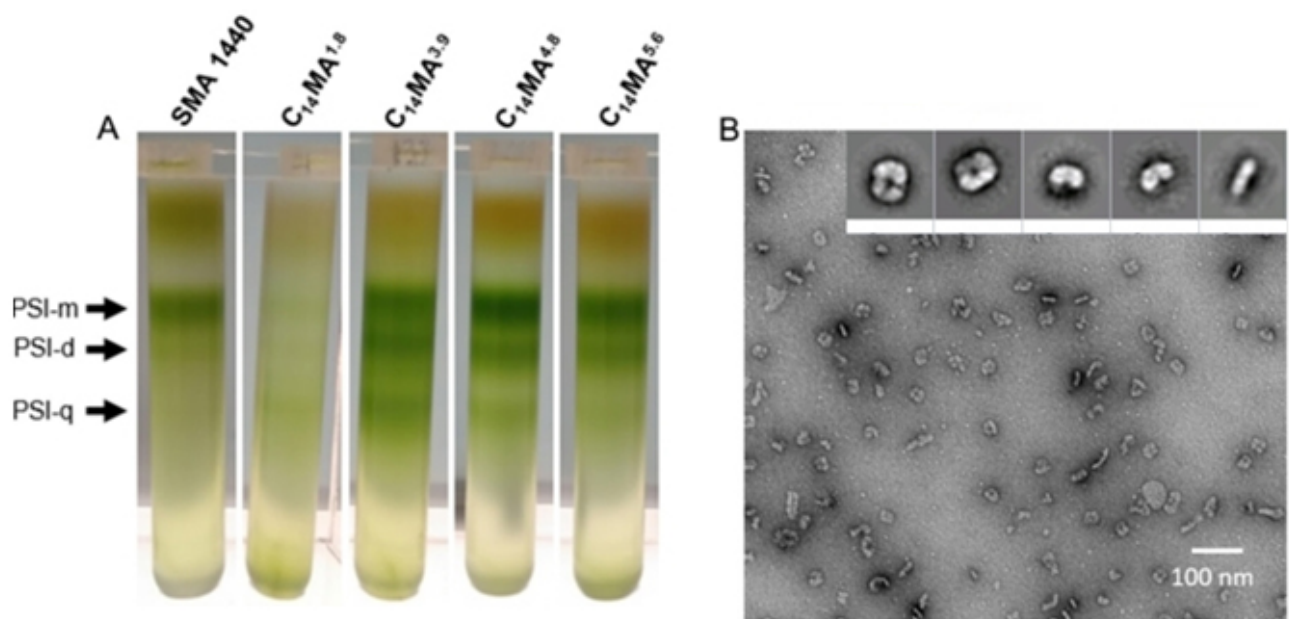


**Figure 1: Comparison of Detergent (DDM) vs non-detergent  $\alpha$ -olefin-maleic acid copolymers ( $\alpha$ MAs) for PSI oligomer isolation.**

- A.** Sucrose density gradient gels of solubilized protein complex extracts following incubation and protein solubilization using  $\alpha$ MA copolymers, a DDM control, and DIBMA. The labels PSI-m and PSI-t correspond to the monomeric and trimeric species of PSI, respectively (from Workman et al., 2023).
- B-E.** Characterization of the trimeric PSI band isolated using different  $\alpha$ MAs. PSI-SMALPs isolated from the sucrose density gradients using: B) UV/Vis Spectroscopy, C) low-temperature fluorescence, D) SDS-PAGE, E) BN-PAGE.
- F.** The size of different  $\alpha$ MAs isolated trimeric PSI-containing nanodiscs determined by dynamic light scattering and plotted against the total lipid number/mg/protein as determined by MS/MS. Analysis shows a clear correlation with DLS size with lipid content but does not correlate with length of the  $\alpha$ MA copolymers.
- G.** Micrograph of trimeric PSI-nanodisc solubilized with  $C_{14}MA^{5.6}$  from *T. elongatus* thylakoids as imaged by transmission electron microscopy. The negatively stained particles are visible under different views. The top section shows 2D class averages of corresponding PSI-SMALPs, mainly PSI trimers, resulting from extensive image analysis of the dataset.
- H.** SANs based model of *T. elongatus* PSI-DDM (left) and PSI-SMALP trimers (right) isolated using SMA-1440 from Brady et al. 2022, with some modifications. The comparison highlights a noticeable size difference between the DDM micelle and the SMALP with PSI inside. Additionally, there is a distinct, oversized maintenance belt made of thylakoid lipids surrounding the oligomeric particle.





**Figure 3.** Images of **A)** sucrose density gradients of the species extracted from TS-821 using a novel polymer  $C_{14}MA$  samples in comparison with SMA 1440 polymer, and **B)** isolated tetrameric PSI-nanodiscs solubilized with  $C_{14}MA^{3.9}$  negatively stained and imaged by transmission electron microscopy. PSI-m, PSI-d, and PSI-q refer to nanodiscs containing monomeric, dimeric, and tetrameric PSI, respectively. Modified from Workman et al. 2023.