Supplemental Figures (as part of Preliminary Data)

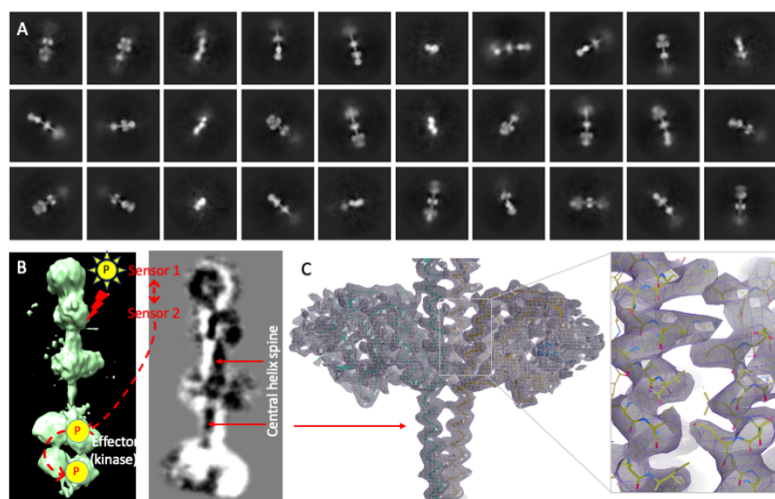**Figure 1. Preliminary single particle analysis of PPHK. A)** 2D classes pf PPHK show the modular dimeric architecture where the N-terminal sensor domains engage no direct contacts with the C-terminal output histidine kinase (HK) domain. The sensor and effector domains are coupled via long signaling helices at the dimer interface. **B)** Left panel illustrates the long-range action of PPHK where two input signals perceived by the tandem sensor domains are integrated to regulate the same remote kinase domain.

Right panel highlights the backbone shapes of PPHK in two distinct conformations as evidenced by their respective cryoEM maps colored in black and white. **C)** A zoom-in view of cryoEM map (green-light-absorbing Pg state; 3.8 Å resolution) shows well-resolved densities in the central helical spine.
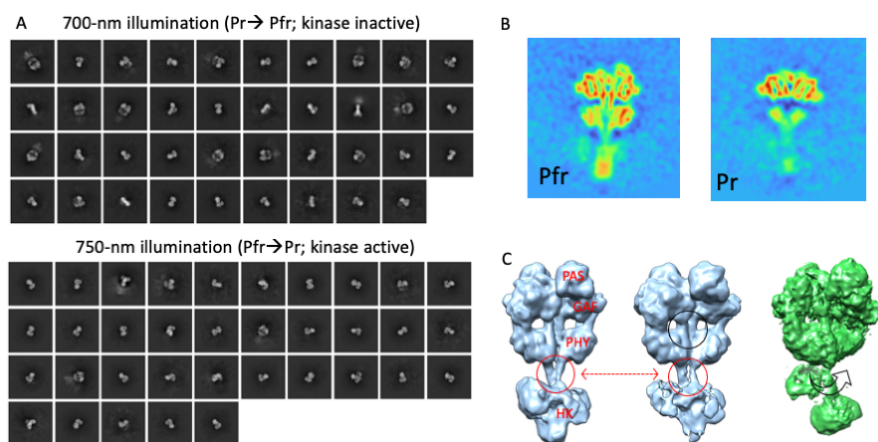

Figure 2. Preliminary data of bacteriophytochrome RpBphP2. A) 2D classes obtained from datasets targeting the Pfr and Pr states. **B)** Side-by-side comparison between central slices of the cryoEM maps of the Pfr and Pr states highlight their drastic differences at the dimer interface. **C)** Resolved conformational

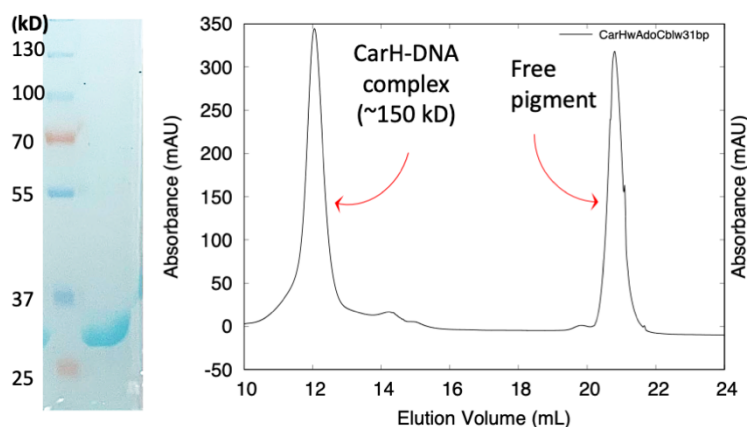states reveal the twist motions in RpBphP2 dimer.

Figure 3. Preliminary data on CarH-DNA complex. Left – SDS-PAGE gel shows the quality of purified CarH protein before assembly. **Right -** Elution profile of size-exclusion chromatography supports the proper assembly of the CarH-DNA complex suitable for single particle imaging.