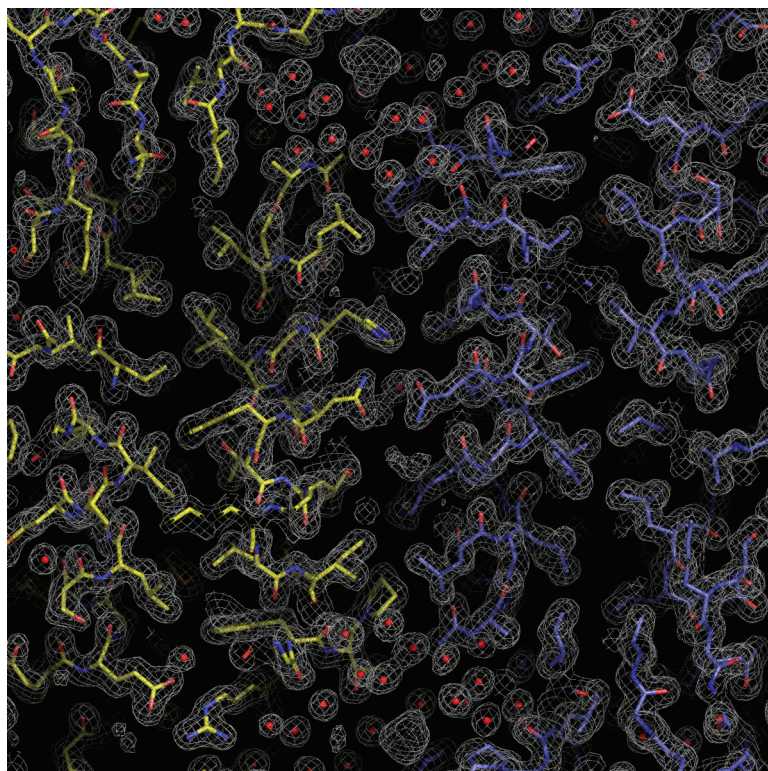
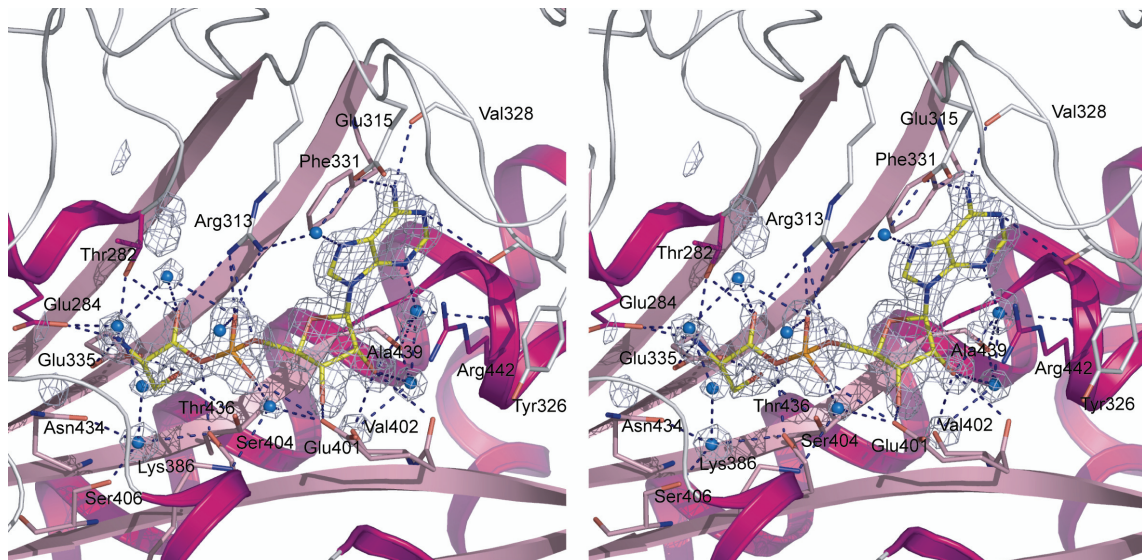


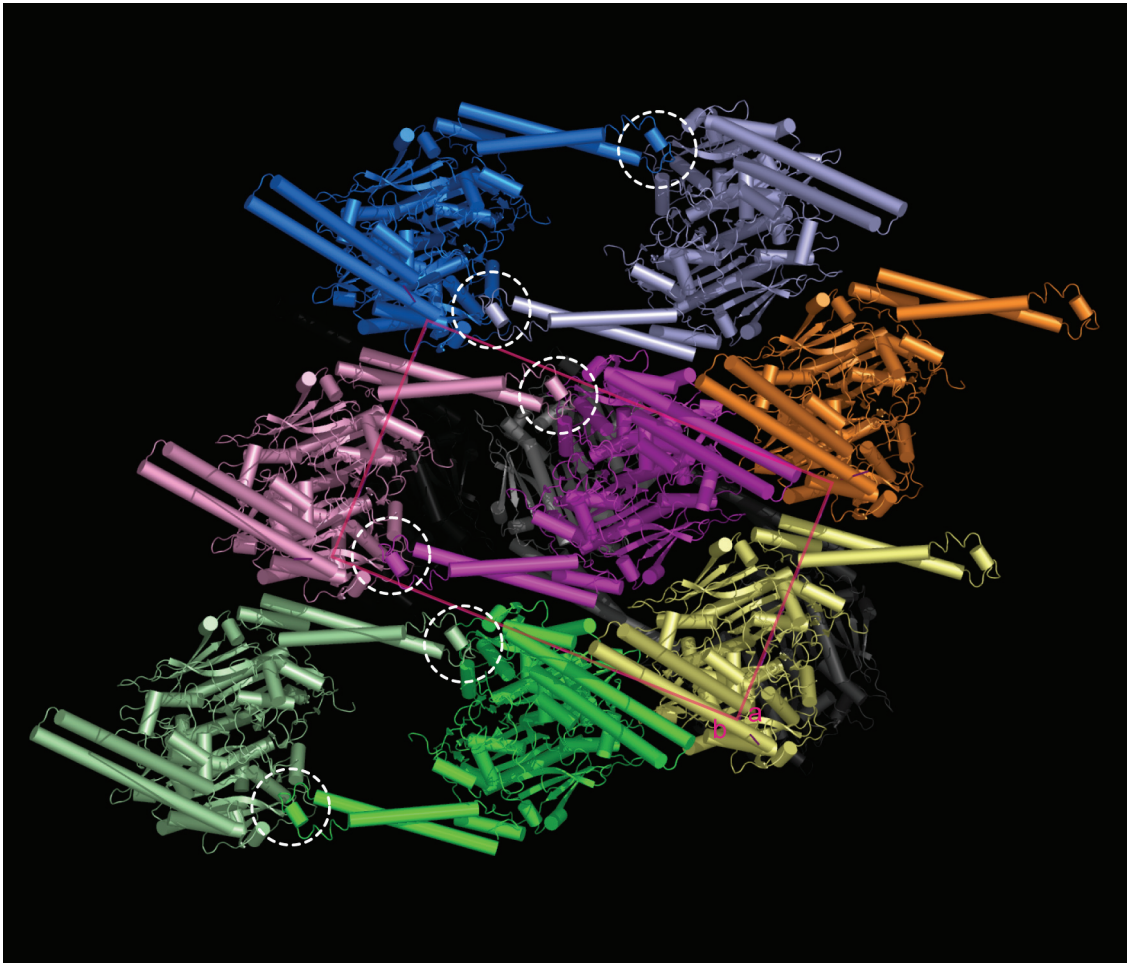
Supplementary Information



Supplementary Figure 1 A representative region of the σ -weighted $|2Fo-Fc|$ difference electron density map calculated by *Lafire* (http://altair.sci.hokudai.ac.jp/g6/Research/Lafire_English.html) in a late state of refinement, contoured at 1.0σ , in the vicinity of the dimer interface (H7) viewed from the backside of molecule. The map is superimposed on the refined model. The carbon atoms in two monomers are colored separately in yellow and blue.



Supplementary Figure 2 Serine discrimination by mt SerRS. Stereo view of final $|F_o - F_c|$ difference omit map contoured at 2.5σ (blue), superimposed on the refined coordinates. The natural intermediate, seryl adenylate, in the active site and the residues contributing to the interactions are shown in stick representation. Nine surrounding water molecules are depicted by blue spheres. Serine specificity is accomplished by hydrogen bonds (dashed blue) with the side chains of Glu335 and Thr436.



Supplementary Figure 3 Crystal packing diagram of mt SerRS looking down the *c*-axis. Each dimer is shown in a different color. The inter-molecular contacts between the tip-loop and the active site are indicated by white dotted circles.