Figure 1. Catalytic reaction and structures of arginyltransferase 1 (ATE1). (**a**) ATE1s catalyze the reaction to covalently link an arginine to an N-terminal or mid-chain glutamate (Glu) or aspartate (Asp). N-terminal and mid-chain arginylation lead to forming of a new peptide bond via the amino group and the side chain carboxyl group of the substrate (yellow box), respectively. (**b**) The arginylation reaction utilizes arginine-charged tRNA (arginyl-tRNA[ARG]) generated by arginyl-tRNA synthetase (ArgRS) as the arginine donor. A substrate with an N-terminal Glu was shown as an example. (**c, d**) 2D class averages of yeast ATE1 in apo-state (**c**) and putative tRNA-bound state (**d**) from a recently purified sample. (**e, f**) Cryo-EM density maps of yeast ATE1 in apo-state (**e**) and putative tRNA-bound state (**f**) were obtained at CWRU following 2 hr data collection. (**g**) Key catalytic intermediates are currently being examined and assembled in the Zhang lab. (**h**) Sequence alignment of yeast and human ATE1s.