



**Additional Figure 1. The active site structure of flavocytochrome  $b_2$ .** The figure is generated according to the molecular structure of flavocytochrome  $b_2$  at 2.4 Å resolution (PDB code 1FCB) [23] with PyMOL (The PyMOL Molecular Graphics System, Version 0.99rc6, Schrödinger, LLC). The pyruvate ligand, as oxidation product of L-lactate, is shown in orange. The residues interact directly to the substrate are shown in blue. The residue labels in parentheses are the corresponding residues of L-iLDH, which are identified by sequence alignment.