

Abstract: Cytochrome *c* oxidase (CcO) is a key enzyme in the mitochondrial respiratory chain, catalyzing the reduction of molecular oxygen to water in the final step of cellular respiration. Structurally, it is a large, oligomeric membrane protein complex composed of 13 distinct polypeptides in mammals and containing essential metal cofactors, including copper and iron centers within its heme groups. Functionally, CcO transfers electrons from cytochrome *c* to dioxygen while simultaneously driving proton translocation across the inner mitochondrial membrane from the matrix space to the intermembrane aqueous medium. This process contributes to the electrochemical gradient that powers ATP synthesis. In this seminar, I will discuss a series of experiments conducted in the Roman laboratory using stopped-flow spectroscopy, which have provided detailed insights into the kinetics of electron transfer and proton pumping in CcO.