A wide range of chemical processes proceed by proton-coupled electron transfer (PCET), from combustion to fuel cells to redox processes of minerals. This presentation will begin with fundamental studies of single reaction steps that involve transfer of one proton and one electron. Some of these reactions ‘look like’ hydrogen atom transfers, while in other reactions the electron and proton are quite separated in the reactants or products, as in the drawing below left. The rate constants for many of these reactions can be understood using a version of Marcus Theory, which shows the commonality of organic and transition metal H-atom transfer reactions. PCET concepts are also being used in the development of new oxygen-reduction electrocatalysts, and to develop the redox reactivity of oxide nanoparticles. For instance, reduced and protonated ZnO and TiO2 nanoparticles will transfer e- and H+ (H•) to nitroxyl and phenoxy radicals, as illustrated below right.

"Proton-Coupled Electron Transfer: From Hydrogen Atom Transfer Reactions to Oxide Nanoparticle Chemistry"