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Biography

Matthew B. Francis is currently the Joel Hildebrand Distinguished Professor and Department Chair of Chemistry at the University of California, Berkeley. In addition, he is a Faculty Scientist at the Lawrence Berkeley National Laboratory. Since starting at Berkeley in 2001, Matt's research program has centered around the development of new organic reactions for protein modification. His group has used these chemical tools to prepare new biomolecular materials for diagnostic imaging, water treatment, biomolecular sensing, and solar cell development.

Abstract title: Protein-Protein Coupling Using Enzymatic Oxidative Coupling Reactions

Abstract

The uniquely diverse structures and functions of biomolecules offer many exciting opportunities for creating new materials with advanced properties. Using only a limited set of side chains and auxiliary groups, they have evolved unparalleled abilities to accelerate chemical transformations, facilitate the delivery of genetic cargo to targeted cells, bind specific analytes in complex mixtures, transduce energy, and generate elaborate three-dimensional structures through self-assembly. Over the years, our lab has sought to incorporate these capabilities into new materials for use in diagnostic imaging, solar energy collection, and water purification. To do this, however, we also needed to develop new chemical strategies that can attach synthetic molecules and polymers to single locations on a wide range of biomolecules. This presentation will focus on the development of a powerful set of oxidative coupling reactions that involve *o*-quinone and *o*-iminoquinone intermediates. These species can modify proteins with very high chemoselectivity and efficiency, and have been adapted for use in a large number of experimental contexts. Newer versions of these reactions involve the use of oxidative enzymes that can generate *o*-quinone intermediates from simple phenols using molecular oxygen as the stoichiometric oxidant. The chemical development of these reactions will be presented, along with several examples of new protein bioconjugates that have been prepared through their use.