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Engineering electron tunneling in natural and artificial proteins¹

P.L. DUTTON, Johnson Research Foundation, Department of Biochemistry and Biophysics, University of Pennsylvania, Philadelphia, PA 19104

Experimental investigation of oxidoreductases has revealed their naturally selected electron tunneling engineering that underlies oxidative and reductive catalysis. This engineering is relatively simple, which allows us to design artificial oxidoreductases from scratch, without the unnecessary complexity found in natural proteins. We have constructed a simple, four α -helix protein bundle protein framework that can be manipulated to support a range of cofactor and substrate binding, and redox and light driven actions. For example, by controlling water access and mobility, this framework can support hemoglobin-like oxygen transport without anything resembling a globin fold. The same framework provides a clear path to artificial proteins designed to catalyze single or multi electron tunneling coupled to chemistry.

¹In collaboration with C.C. Moser, Johnson Research Foundation, Department of Biochemistry and Biophysics, University of Pennsylvania.