Measuring Reaction Rate Constants With Optical Biosensors

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Abstract

Many biochemical reactions involve a stream of chemical reactants flowing through a fluid-filled volume, over a surface to which receptors are confined. Such surface-volume reactions occur during blood clotting, drug-protein interactions, and DNA-damage repair. Scientists measure reaction rate constants associated with these reactions using optical biosensors: an instrument in which reactants are convected through a flow-cell, over a surface to which other reactants are immobilized.

Scientists currently study biosensor experiments which involve multiple interacting components on the sensor surface. We discuss a partial differential equation model for multiple-component reactions in optical biosensors. Thanks to high Peclet number flow, this model reduces to a set of nonlinear integrodifferential equations for the reacting species concentrations, which in turn reduces to a set of ordinary differential equations which can be used to measure rate constants using biosensor data. We conclude by discussing recent developments on a related problem concerning instruments involved in creating personalized medicine.