The Limits of "Kinetic Capillary Electrophoresis" and "Kinetic Separation" as a Way to Overcome Them

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Kinetic Capillary Electrophoresis (KCE), which is an inclusive extension of Affinity Capillary Electrophoresis (ACE), is a capillary electrophoresis (CE)-based methodological platform for studying biomolecular interactions. KCE has important advantages over other platforms - fluorescence spectroscopy, biosensors, and microcalorimetry - used for "interaction" studies. In contrast to fluorescence spectroscopy and biosensors, KCE does not necessarily require labeling or immobilization of one of the binders. In contrast to microcalorimetry KCE can be used not only for equilibrium but also for kinetic studies. KCE can thus uniquely facilitate label- and immobilization-free kinetic studies of biomolecular interactions. These advantages do not come without an expense – KCE is not perfectly generic, as it can only be applied to systems in which a complex can be electrophoretically separated from the spectroscopically visible analyte. Subsequently, KCE can only be universally applied to systems with predictively different electrophoretic mobilities of the complex from the unbound molecules. The most studied universal example is protein-nucleic acids interactions, in which the complex has always lower density of negative charge per until of size than a nucleic acid. KCE cannot be generically applied to such important systems as protein-protein and protein-drug interactions. We believe that the limitations of KCE can be overcome by expanding the theoretical foundation of KCE to other separation platforms, e.g. chromatography and centrifugation. In this lecture, I will expand general principles of KCE to Kinetic Separation and demonstrate the first examples of application of Kinetic Separation to studies of protein-drug interactions.