

## **Systems Biology Challenges in the Capillary Electrophoresis of Cell Signaling Network**

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Due to a complex nature of signal transduction pathways, it is intuitively difficult to understand the systematic relationship between signaling molecules and cellular processes. Emerging systems biology approach, relying on various experimental techniques and methodologies coupled with computational modeling, will be an essential component of analysis of the behavior of cell signaling network. To address the functional relationships of the dynamics of biological networks and pathways, our lab utilizes the conceptual framework of biological experiments, bio-analytical techniques and computational simulations. Systems based analytical strategies were focused towards the use of high performance capillary electrophoresis, mass spectrometry and matrix assisted laser desorption/ionization time-of-flight mass spectrometry to monitor the signaling proteins. Traditional wet cell biological experiments were aimed to study the growth factor and cytokine effects on ERK, AKT, STAT signaling systems in PC12 cells. Furthermore, we have conducted computational simulation study of signal transduction underlying MAPK, PI3K/Akt and JAK/STAT pathway based on the biochemical parameters. Thus, a systematic approach using traditional wet biology experiments together with bio-analytical and mathematical modeling greatly improve our understanding the behavior of complex signal transduction pathways. Our goal is to understand the whole mechanism of various cellular processes by use of this systematic approach.