

# Single Cell Omics Research by Capillary Electrophoresis Coupled with Mass Spectrometry (CE-MS)

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Our human body consists of numerous cells, where different kinds of cells beautifully synchronize to construct complicated tissue structure. As recent research shows each cell has “personality” not only in intact tissues but also in undifferentiated iPS cell culture line, microscale bioanalysis with single-cell resolution is quite an important technology for understanding the complicated biosystem. How to obtain “omics” information is also important challenge for our deep understanding of cellular networks.

Here I focused on capillary electrophoresis (CE) coupled with mass spectrometry (MS). CE is a powerful separation technique that is quite compatible for microscale bioanalysis (~nL volume), and MS provides high qualification and zmol-order (several hundreds of molecules) detectability, which is high enough potential for single cell omics research. CE-MS is promising as next generation bioanalysis, however, neither single cell metabolomics, proteomics, nor glycomics has been achieved. As each analytical element has enough potential for single cell analysis, thus, how to hyphenate them to construct “total analysis system” including sample collection, pretreatment, separation, and detection is very important.

Our recently developed single cell analysis system is shown in the figure: single cell is picked up with micromanipulator; lysed in a microtube; chemical/enzymatic reactions are carried out; injected to a capillary; concentrated inside the capillary; electrophoretically separated; and detected with MS. Almost all complicated processes are done in a microtube, flexible and robust omics analysis is achieved. In this presentation, demonstration of metabolomics, proteomics, and glycomics will be introduced.

