Applications of Precision, Real-time Cell Biomass Measurements in Cell Physiology and Drug Development

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***Short Abstract* — Live Cell Interferometry (LCI) is a new technology for biomass profiling of single living cells or cell clumps (3D structures) with picogram sensitivity. It has shown highly repeatable (<1% coefficient of variation) quantification of cellular biomass, mass accumulation or loss rates, and mass distributions for medium-sized populations of cells (10^3) on a single cell basis, and has broad potential application in studies of normal cell physiology, cancer, and additional diseases showing aberrant growth and deregulation of cell biomass control. Our poster will discuss our group's recent applications of LCI technology for conducting single cell drug response assays, studying biomass dynamics in stem cell differentiation and for detecting subtle drug-induced aberrations in mass partitioning during cell division.**

***Keywords* — Biomass Profiling, Single-Cell, Drug Development, Stem Cell Differentiation, Cell Division**

I. Background Information

LIVE Cell Interferometry (LCI) is a new technology for biomass profiling of single living cells or cell clumps (3D structures) with picogram sensitivity. LCI quantifies the shift in phase imparted to light propagating through a transparent cell body, which is proportional to biomass. It has shown highly repeatable (<1% coefficient of variation) quantification of cellular biomass, mass accumulation or loss rates, and mass distributions for medium-sized populations of cells (10^3) on a single cell basis, and has broad potential application in studies of normal cell physiology, cancer, and additional diseases showing aberrant growth and deregulation of cell biomass control [1, 2].

II. Results

Our group has successfully utilized LCI to accurately quantify the sensitivity of single cell and colony-forming human breast cancer cell lines to the HER2-directed monoclonal antibody, trastuzumab (Herceptin). Relative sensitivities were determined tens-to-hundreds of times faster than possible with traditional proliferation assays [1].

Currently, we are using LCI to investigate the sensitivity of established human melanoma cell lines to the B-Raf enzyme inhibitor vemurafenib (Zelboraf). Additionally, our LCI has demonstrated accuracy in measuring smaller human cell types in a recent collaboration investigating mast cells and their degranulation process.

Finally, our group is in the initial phases of using LCI to study the recovery of immune system cells following stem cell transplantation in patients with blood and bone marrow cancers in order to predict the onset of graft-versus-host disease.

III. Conclusion

Live Cell Interferometry enables real-time quantification of single-cell and cell cluster mass with picogram sensitivity. It can be used to accurately predict drug sensitivity in cell samples hours faster than gold-standard clinical growth assays. Our LCI's increased speed of analysis and quantification of therapeutic responses for aggregated cell clumps, sheets, and spheres provides exciting new opportunities for agent selection, prognosis in solid tumor therapy, applications in the study of immune cell function, and delving further into basic cell physiology.

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References

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