COMPACT CELL CULTURE IMAGING SYSTEM USING FOURIER PtyCHOGRAPHIC MICROSCOPY

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The ability to obtain image data of multiple cell cultures simultaneously over a long-term period can provide researchers with a wealth of information. However, commercial systems rely on conventional microscopes, which are limited by their space-bandwidth product (SBP) [1]. Additionally, existing solutions that address the SBP limitation, are not conducive to well-plate imaging, which are an in-vitro culturing standard [2]. Using the benefits of Fourier ptychographic microscopy (FPM), these physical limitations can be transformed into problems that can be solved in the digital domain [3]. Our lab has demonstrated a compact, six-well plate imaging system, which is small enough to be housed inside an incubator. This system incorporates six individual microscopes that were constructed using pairs of 0.1 NA, 4x magnification objective lenses as both the objective lens and tube lens. Each microscope provides 1:1 imaging with a large field of view onto low-cost CMOS sensors. To overcome the system’s physical restrictions and native resolution, we used the FPM technique to reconstruct higher resolution bright field images, along with phase information. Additionally, this system can provide fluorescent imaging at its native resolution. The system was shown to have a synthetic NA of about 0.42 and a depth of field of 0.2 mm. Overall, the demonstration of this system highlights the feasibility of a cell culture imaging system that can be extended and parallelized for high-throughput imaging.

