

Optical trapping and surgery of living yeast cells using a single laser

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ABSTRACT: Near-infrared (NIR) lasers have recently found numerous applications in biomedical research due to their non-destructive or localized effects on cells and tissues. Using a continuous-wave (CW) NIR laser for optical trapping has been demonstrated as a contact-free and non-invasive tool for cell and organelle manipulation [1, 2]. Furthermore, recent developments in ultrafast technology of femtosecond-pulsed lasers have extended the application of NIR lasers to cellular surgery and stimulation [3, 4].

Here, we present optical trapping and surgery of living yeast cells using two operational modes of a single laser. Living yeast cells are exposed to focused CW and femtosecond-pulsed focused laser of 780 nm wavelength. We show that a focused laser beam operating in CW mode does not show any destructive effect on yeast cell wall, and can be used for non-invasive optical trapping and manipulation of single yeast cell. By changing the operation of the laser to femtosecond-pulsed mode, we show that a tightly focused beam dissects the yeast cell walls via non-linear absorption. Lastly, using the combined technique of optical surgery and trapping, we show intracellular organelle extraction and manipulation from a yeast cell. The technique established here will be useful as a simple method for both surgery and manipulation of living cells using a single laser beam.

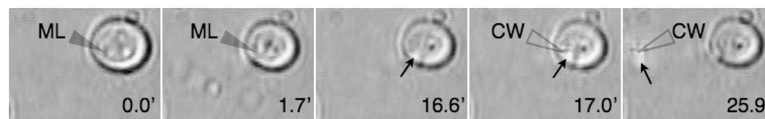


Figure 1: Intracellular organelle extraction and manipulation using the combined technique of optical surgery and trapping.

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