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Near-infrared femtosecond laser assisted cell membrane permeabilization CHENG PENG, ROBERT PALAZZO, INGRID WILKE, Rensselaer Polytechnic Institute — The controlled delivery of membrane impermeable molecules into single living cells (micro-injection) is important for a variety of applications such genomics, proteomics or drug screening and testing. Recently, it has been demonstrated that opto-injection with tightly focused (∼300nm) femtosecond (fs) laser pulses at near-infrared (nir) wavelengths (700-1100nm) has the potential to create highly localized transient pores in single living cells with high cell survival rates and transfection efficiency. We have investigated the creation of transient pores in single living BAEC cells by focused fs nir laser pulses dependent on the incident laser intensity by dye uptake studies. Our experimental data agree very well with the experimentally and theoretically determined thresholds for laser-induced plasma formation and LIB. We observe that pore creation is observed for laser intensities of $4.0 \times 10^{12} W/cm^2$ and higher. For laser intensities above $3.3 \times 10^{13} W/cm^2$ BAEC cells are irreversibly destroyed. Within these two limits the pore size increases logarithmically with increasing laser intensity. This functional dependence is explained by considering the Gaussian intensity distribution across the laser focal spot. The physical understanding of the relationship between pore size and laser intensity allows the control of the number of molecules delivered into a cell per unit time through the control of the pore size.

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