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Potential Applications of Light Robotics in Nanomedicine

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We have recently pioneered a new generation of 3D micro-printed light robotic structures with multi-functional biophotonics capabilities. The uniqueness of this light robotic approach is that even if a micro-biologist aims at exploring e.g. cell biology at nanoscopic scales, the main support of each micro-robotic structure can be 3D printed to have a size and shape that allows convenient laser manipulation in full 3D – even using relatively modest numerical aperture optics. An optical robot is typically equipped with a number of 3D printed "track-balls" that allow for real-time 3D light manipulation with six-degrees-of-freedom. This creates a drone-like functionality where each light-driven robot can be e.g. joystick-controlled and provide the user a feeling of stretching his/her hands directly into and interacting with the biologic micro-environment. The light-guided robots can thus act as free-floating probes to monitor micro-biologic processes and provide spatially targeted mechanical, chemical or even optical stimuli that would otherwise be impossible to achieve in a full 3D biologic environment.

- Palima, D., Bañas, A., Vizsnyiczai, G., Kelemen, L., Ormos, P., Glückstad, J., "Wave-guided Optical Waveguides", *Opt. Express* 20, 2004 (2012).
- Palima, D., & Glückstad, J., "Gearing up for optical micro-robotics: synthetic microstructures actuated by optical trapping and optical manipulation", *Lasers & Phot. Reviews* 17, 478 (2013).
- Wu, C., Palima, D, Novitsky, A; Ding, W; Gao, D; Shukovsky, S; and Glückstad, J., "Engineering light- matter interaction for emerging optical manipulation applications", *Nanophotonics* 3, 181 (2014).
- Villangca, M., Bañas, A., Palima, D., and Glückstad, J., "Dynamic diffraction-limited light-coupling of 3D- maneuvered wave-guided optical waveguides," *Opt. Express* 22, 17880 (2014).
- Villangca, M., Bañas, A., Palima, D., Glückstad, J., "Generalized phase contrast-enhanced diffractive coupling to light-driven microtools" *Opt. Eng.* 54, 111308 (2015).
- Villangca, M., Casey, D., Glückstad, J., "Optically-controlled platforms for single- and sub-cellular transfection and surgery," *Biophysical Reviews* 7, 379 (2015).
- Villangca, M., Palima, D., Bañas, A., Glückstad, J., "Light-driven micro-tool equipped with a syringe function," *Light: Science & Applications*, Nature Publ. Group, 5 e16148; doi:10.1038/lsa.2016.148 (2016).