

## MICROBOTICS

Nanoscribe's Photonic Professional GT2 3D printer allows to build complex and custom 3D micro tools with sizes of few micrometers up to the millimeter scale. It enables the fabrication of microrobots that interact with tissue and single living cells and conduct medical tasks at the micro scale. Remotely controlled micromachines, which can be powered by magnetic, chemical or optical actuation, are crucial for minimally invasive operations. Depending on the desired actuation mechanism microrobots can be printed from photopolymers, nanoparticle composites as well as hydrogels. Metallic coatings can be applied if required.

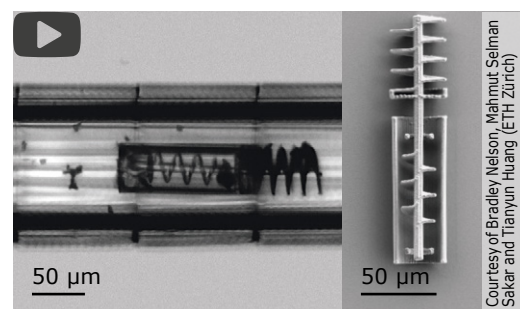


### MICROTRANSPORTERS FOR TARGETED DRUG DELIVERY

**Challenge:** Controlled loading, transport and release of therapeutic agents in fluids by means of a microtransporter remotely actuated by a magnetic field that rotates a magnetic shaft.

**Solution:** The complete transporter is printed without further assembly. A sacrificial printed shell allows for selective coating of the structure with Ni/Ti.

**Source:** DOI: 10.1002/adma.201503095



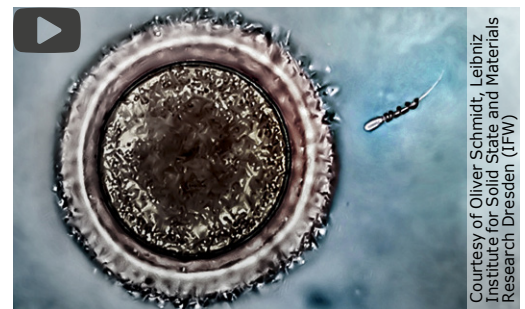
Courtesy of Bradley Nelson, Mahmut Selman Sakar and Tianyun Huang (ETH Zürich)

### FERTILIZATION-ASSISTING MICROMOTORS

**Challenge:** Cell-compatible micromachine able to catch, transport and release living sperm to an oocyte overcoming low sperm motility-induced fertility issues.

**Solution:** Printed polymer microhelices are coated with nickel and titanium allowing the helices to act as motors in a magnetic field and providing biocompatibility, respectively.

**Source:** DOI: 10.1021/acs.nanolett.5b04221



Courtesy of Oliver Schmidt, Leibniz Institute for Solid State and Materials Research Dresden (IFW)

### OPTICAL MICROSYPHINGE

**Challenge:** Micro tool capable of movement with six degrees of freedom and controlled as well as precise cargo loading, transport and release.

**Solution:** A hollow micro vessel with several trapping handles is printed and moved by optical tweezing. Optically changing the pressure inside the vessel allows for loading and unloading of particles.

**Source:** DOI: 10.1038/lisa.2016.148



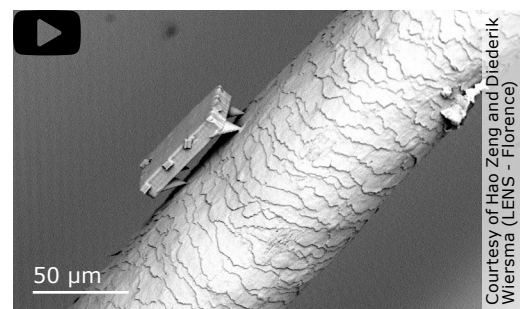
Courtesy of Jesper Glückstad (DTU)

### LIQUID CRYSTAL ELASTOMER (LCE) MICROWALKER

**Challenge:** Soft microrobot that reversibly deforms and is powered by light for walking and jumping, overcoming strong surface adhesion.

**Solution:** Conical legs are printed on a previously printed LCE structure to reduce adhesion. Modulated laser light contracts the robot body, changing the tilt of the legs leading to locomotion.

**Source:** DOI: 10.1002/adma.201501446



Courtesy of Hao Zeng and Diederik Wiersma (LENS - Florence)



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