MMI
SINGLE CELL SOLUTIONS

CellManipulator: Advanced Laser Tweezers System

It's a Trap!

Real-time Manipulation
and Visualization
of Molecular Interactions

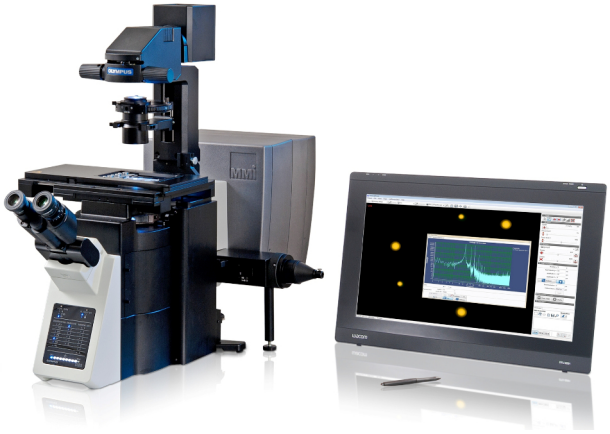
www.molecular-machines.com

The most flexible optical trapping system

The MMI CellManipulator is the most powerful optical multibeam tweezers based on the mechanical forces arising from a strongly focused laser beam. It enables comfortable, ultra-precise and contact-free manipulation of microscopic particles, single or living cells, or subcellular organisms and the measurement of intracellular activities.

I like to Move It

You can hold, move, rotate, join, separate, stretch or otherwise manipulate up to 2x10 microscopic objects simultaneously or separately in three dimensions. The wavelength of the laser does not interfere with the integrity of living specimens.



The MMI CellManipulator on the Olympus IX83 inverted microscope. The system is extremely customizable with a wide range of microscope brands and models

Keep it Flexible

CellManipulator is the most flexible optical tweezers. Compatible with almost all inverted or upright research microscopes. It is easily extendable to fluorescence, TIRF, Confocal Microscopy and many more customized adaptations. The high flexibility ensures a wide range of applications.

Huge Work Space

The entire laser beam control is located underneath the trapping lens. This open space architecture provides unrivalled free space above the optical trap. Perfect for customizable force measurements and other applications.

Become an Expert in 10 min

With the intuitive and flexible MMI CellTools analysis software, you can simply organize and manipulate your traps. Optical Trapping was never so easy.

Finest Force Measurements

Sub-pN resolution imaging detectors deliver your force data with fully automated calibration procedures. No compromise in work space.

The Strongest Trap

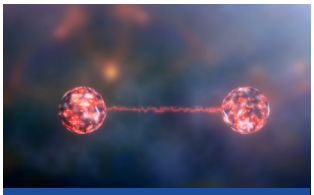
Use the optical tweezers with the strongest trap on the market with > 1200 pN resolution. Never lose your particle.

How can it be applied to your research?

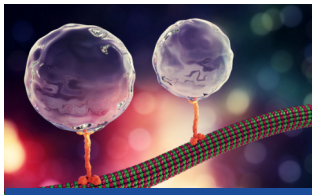
You want to make novel discoveries in life science? You want to investigate molecular motor mechanics, binding/elasticity of DNA and proteins, cell membrane dynamics, particle uptake into cells, or you want to make some studies on other research topics? No problem! We work on a personal level to find the right solution for you.

High modularity is key

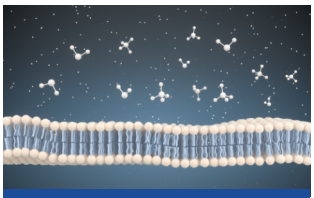
The compact MMI CellManipulator is a modular system, which can be composed individually according to your needs and experimental requirements. It is compatible with all other MMI Single Cell Solutions (CellCut, CellEctor & CellDetector).



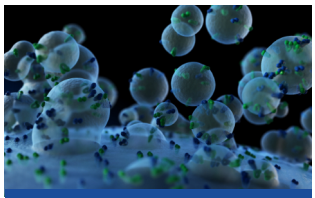
DNA/RNA-Protein Interactions



Molecular Motor Mechanics



Cell Membrane Dynamics



Cellular Structure & Transport

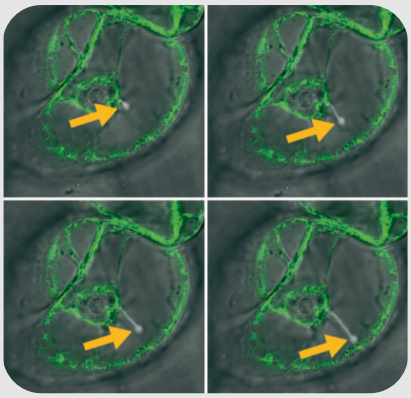
Actin and myosin regulate cytoplasm stiffness in plant cells: a study using optical tweezers

Laboratory of plant cell biology, Wageningen University, The Netherlands

Summary

Here, we produced cytoplasmic protrusions with optical tweezers in mature BY-2 suspension cultured cells to study the parameters involved in the movement of actin filaments during changes in cytoplasmic organization and to determine whether stiffness is an actin-related property of plant cytoplasm.

Optical tweezers were used to create cytoplasmic protrusions resembling cytoplasmic strands. Simultaneously, the behavior of the actin cytoskeleton was imaged.



Formation of tweezers-formed cytoplasmic protrusion of tabacco BY-2 suspension cultured cells

After actin filament depolymerization, less force was needed to create cytoplasmic protrusions. During treatment with the myosin ATPase inhibitor 2,3-butanedione monoxime, more trapping force was needed to create and maintain cytoplasmic protrusions. Thus, the presence of actin filaments and, even more so, the deactivation of a 2,3-butanedione monoxime-sensitive factor, probably myosin, stiffens the cytoplasm.

Conclusion

Myosin-based reorganisation of the existing actin cytoskeleton could be the basis for new cytoplasmic strand formation, and thus the production of an organised cytoarchitecture.

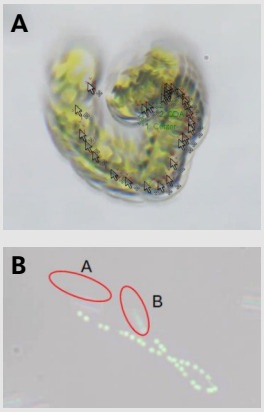
Optical trapping and force spectroscopy of non-spherical rod-shaped bacteria and diatoms

Institute for Environmental Engineering, Department of Civil, Environmental and Geomatic Engineering, ETH, Zurich, Switzerland

Summary

In this white paper, we have employed optical tweezers (MMI CellManipulator) to trap and immobilize bacteria and diatoms. Their motility and adhesion to surfaces is associated with a wide range of biological processes.

Marinobacter adhaerens bacteria are small and rod-shaped, and they adhere to surfaces or are very dynamic in the medium. *Thalassiosira weissflogii* diatoms, in contrast, are larger in size. They have non-spherical elongated shape. Since optical tweezers are known to work best with round objects, the optimal and non-toxic manipulation of M. adhaerens and T. weissflogii is critical and challenging.



(A) Trapped diatom followed the optical tweezers trap movement. **(B)** Bacterium, that adhered to the surface of the cover slip, was detached from the surface and moved to different positions.

Conclusion

In this study, we demonstrated that the MMI CellManipulator optical tweezers system is an easy to use system to create stable and adjustable trapping forces which is applied to manipulate rod-shaped living organisms such as bacteria and diatoms. Optical tweezers are known to sufficiently trap spherical particles but facing difficulties in manipulating the elongated objects. This study highlights that optical trapping can also be applied for elongated cells.

Interestingly, the rod-shaped cells orient themselves along the laser beam axis. This study opens the door to further trapping experiments with rod-shaped organisms, especially including force spectroscopy measurements in physiological conditions.

Better service starts here

"The MMI CellManipulator optical tweezers were customized on an upright microscope upon our request. The tweezers have been working reliably, with excellent manipulation power and flexibility on various devices, from simple glass slides to microelectrodes on silicon. The MMI service was also professional, fast and considerate"

Chengxun Liu, Ph.D.
Bio-Nano Electronics Department
Imec Belgium

★★★★★

Manufacturer: Molecular Machines & Industries Germany | Switzerland | Hong Kong | USA
Breslauer Strasse 2, 85386 Eching, Germany • Phone (Germany): +49 89 319 048 40 • Phone (USA): +1 331 307 0273
Email: info@molecular-machines.com • **www.molecular-machines.com**

Visit the MMI website