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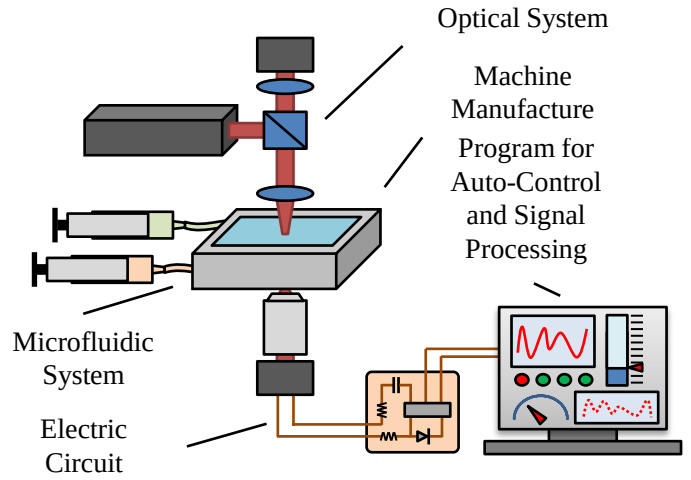
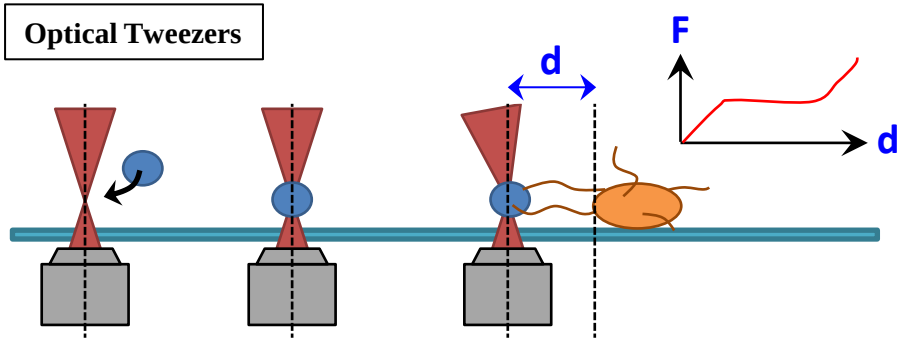
Cellular Mechanics, Opto- and Dielectro- Cell Manipulation, Design and Construction of Optomechatronic platform for Biophysics

Biophysics Lab: Opto- and electro- Lab. & Class II Bio- Lab.

1. Learning by Doing: From elements to system design and construct. Basic training includes (1) Integration of electric circuit and LabVIEW programing to control system and signal process, (2) Study, design and construction of optical system.
2. Three powerful biophysical techniques: (1) Optical Tweezers (left part of bottom sketches), (2) Opto-Dielectric Tweezers, (3) Atomic Force Microscopy (right part of bottom sketches). Mechanics of Bacterial and cellular could be studied by these tech. such as elasticity of cell body or adhesive force of bacterial pili.

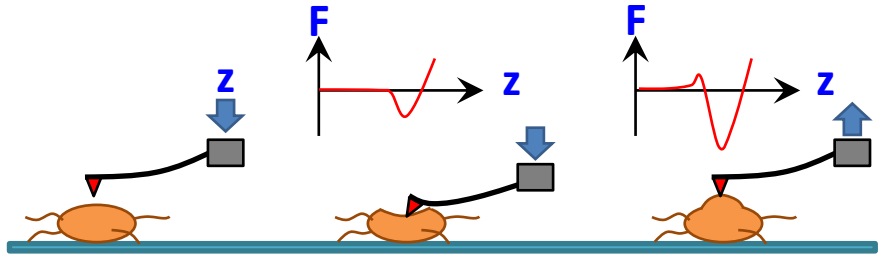


Optical Tweezers



A laser beam highly focused by an objective lens, particles or cells could be trapped on the focal spot. Such technique is called “optical tweezers, OT”. We let a 1 μm bead attached to bacterial pili. Then, using OT to hold and pull the bead against pili. Finally, a F-d relation will be observed which reflects the adhesive property of bacterial pili.

Atomic Force Microscopy



Everything are consist of atoms. The van der Waals force appears significantly once two object get very closely in nm scale. The “atomic force microscopy, AFM” is based on the physical phenomenon. We use a tip with nm scale top to approach and press on a cell surface. By recording and analysis the tilt of the tip, the elasticity of cell body could be measured.