Sunday, February 20
10:30 AM – 12:00 PM
Esplanade, Room 158
Axiom Optics

SENSOCELL: Optical Tweezers Integrating Direct Force Spectroscopy & Correlated Fluorescence Imaging For Extra- and Intra-Cellular Mechanobiology

Optical tweezers (OT) were first applied to biology research questions in the early 90s, and since then they have been primarily used for molecular biology applications. Conversely, their use in cell biology research has been greatly limited to trapping experiments intended for moving or manipulating living cells. The sparsity of quantitative experiments using OT in living cells is mainly due to the difficulties in measuring readily and accurately the forces applied by OT onto the probed samples.

Here we present our distinctive OT platform SENSOCELL for Mechanobiology research, which allows users to carry out direct force measurements *in vitro*, *in vivo* or *in situ.* Molecules and cells can be manipulated and probed using microspheres as handles in *in vitro* conditions. Alternatively, forces can be directly applied and measured on cells (trapping cells as a whole) or inside cells, either via exogenous spherical particles or directly trapping endogenous cellular structures such as lipid vesicles, the cell membrane, the cell nucleus or other organelles. Thanks to its unique direct force sensor based on the analysis of light momentum changes, measurement protocols with SENSOCELL are unhindered by recurrent trap stiffness calibrations, allowing experiments to be carried out in an easy and speedy manner by non-expert users.

The flexibility offered by SENSOCELL for controlling multiple traps (up to 256) with simultaneous force measurements increases throughput and allows advanced protocols for extra- and intra-cellular mechanics. The control software includes built-in routines that allow performing active micro-rheology measurements, clamping forces for particle tracking and creep tests or designing stress-relaxation experiments. The platform is integrated on customizable scientific inverted microscopes and can be combined with fluorescence imaging techniques such as Confocal, Spinning Disk, epi-FL or TIRF.

Key applications include:

- Active micro-rheology in cells and scaffolds
- Cell nucleus stretching and indentation
- Measurement of membrane tension
- Membrane tether pulling
- Microtubules and motor proteins activity
- Cell-cell interactions
- Cell-particle interactions
- Microswimmer force dynamics

In our presentation, we will shortly introduce the key distinctive features of our technology and show examples and results obtained by our customers and scientific collaborators for the aforementioned applications in living cells.

Speaker

Oriol Nos, CEO, IMPETUX