Cytomass Monitor

Monitoring the mass of a single cell in physiological conditions

Integrated solution

Long-term viability of cells

Opens the door to fascinating new experiments

Published in Nature

Inertial picobalance reveals fast mass fluctuations in mammalian cells
Martinez-Martin *et al.*, Nature **550**, 500-505 (2017)

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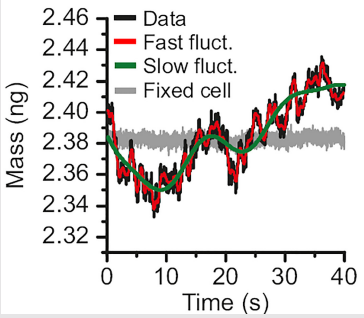
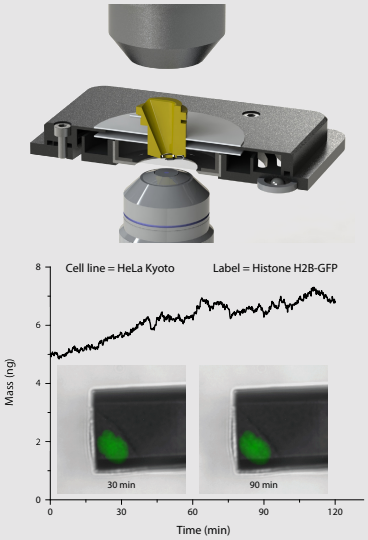
Cytomass Monitor



In their recent Nature publication, Martínez-Martín et al. observed that the mass of living mammalian cells intrinsically fluctuate by around 1–4% over timescales of seconds throughout the cell cycle. Perturbation experiments link these mass fluctuations to the basic cellular processes of ATP synthesis and water transport. It was also shown that growth and cell cycle progression are arrested in cells infected with vaccinia virus, but that mass fluctuations continue until cell death. Their measurements suggest that all living cells show fast and subtle mass fluctuations throughout the cell cycle.



Optical microscope integration and full temperature, gas, and humidity control allow continuous monitoring of cells over a long period of time (up to days) with optical techniques (e.g. DIC, fluorescence) in addition to mass measurements. Images in graph show a time series of Histone H2B-GFP-labelled HeLa cells attached and growing on the Cytomass Monitor's cantilever. Data courtesy Müller lab ETHZ.

Measuring and monitoring the mass of a single cell in physiological conditions

Cells tightly regulate their mass and volume during development and homeostasis. Though this regulation is fundamental to proper functioning of the cell, it is so far poorly understood, mainly because current tools can only reasonably determine the volume of spherical suspended cells (~1% population accuracy, ~20% single cell accuracy), not their mass and not under normal adherent growth conditions.

Together with Prof. DJ Müller and Dr. D Martínez-Martín of the ETH Zurich, Nanosurf is developing the Cytomass Monitor. This cantilever-based instrument is able to measure the mass of even single adherent cells with 0.1% mass and 10-ms temporal resolution.

Working principle

Gentle cantilever vibration (< 5 Å)

$$f_0 = \frac{1}{2\pi}\sqrt{\frac{k}{m^*}}$$

f_0 : Resonance freq.
k : Spring constant
m^* : Effective mass

Key Features

- Ability to accurately and continuously measure (monitor) the mass of cells in physiological conditions (cell culture) over days with millisecond resolution
- Ability to measure the mass of adherent cells while being anchored to physiologically relevant substrates (e.g., collagen, fibronectin, vitronectin, laminin)
- Ability to measure the mass of a group of cells or of a small piece of tissue, allowing to study the influence of cell-cell interactions on mass changes
- Ability to measure the mass of suspended cells by immobilizing them
- Fully compatible with state-of-the-art cell biology optical microscopy techniques

Key applications

- Cell mass or volume regulation
- Cell migration
- Cell nutrition
- Cell division and cell cycle progression
- Fat cell storage and metabolism
- Viral infection-related processes
- Ion channel properties
- Drug screening for drugs targeting pathways linked to cell growth
- New therapies for cancer, aging, obesity, type 2 diabetes, neurodegeneration, and other diseases linked to a deregulation of growth control

Groundbreaking research

Interested in becoming a Cytomass Monitor pioneer?

Then stay ahead of your peers and contact us now at info@nanosurf.com !

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