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Master Project: Automation of Particle Tracking for Assessing Cellular Transport Properties in Genetically Modified Cells

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Introduction:

The inner workings of cells are governed by transport phenomena, understanding how genes affect the visco-elastic properties of a screening of the genome of cells. In this master's thesis we will develop an automated imaging and particle tracking system for high throughput microrheological analysis[1] of fluorescent tracer particles within cells. Through a systematic screening process, we will investigate the influence of gene knockouts on cellular viscosity, which has broad implications for understanding cellular dynamics[2]. This research could give novel insights into gene functions, related to viscosity regulation, which can be highly relevant in biomedicine. This project will be in collaboration with the Laboratory of Adriano Aguzzi from the University of Zürich, who are experts in the gen-editing of mammalian cell lines. Our objective is to develop a robust automated imaging system, conduct a comprehensive screening of different gene knockouts, and develop methods for analyzing and visualizing large datasets to draw meaningful conclusions about the impact of gene knockouts on cellular viscosity[3].

Objective:

1. Gene Knockout Screening: Conduct a comprehensive screening of different gene knockouts to identify and understand the genes that influence cellular viscosity and the capability of viscosity regulation within mammalian cells.
2. Data Analysis and Visualization: Develop methods for analyzing and visualizing the large datasets generated during the high-throughput screening to draw meaningful conclusions about the impact of gene knockouts on cellular viscosity.

Methods used in the project:

- Fluorescent Microscopy
- Image analysis and particle detection and tracking algorithms.
- CRISPR gen-editing

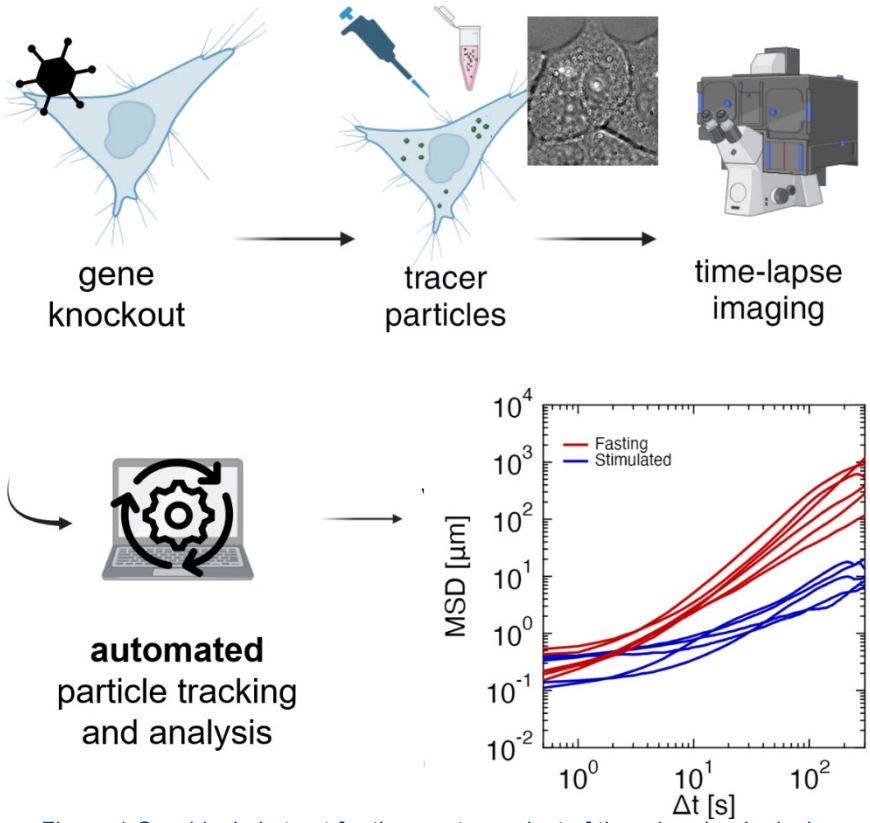

Figure 1 Graphical abstract for the master project of the microrheological evaluation of cell

References

[1] Schultz, K. M., & Furst, E. M. (2012). Microrheology of biomaterial hydrogenators. *Soft matter*, *8*(23), 6198-6205.
[2] Crocker, John C., and Brenton D. Hoffman. "Multiple-particle tracking and two-point microrheology in cells." *Methods in cell biology* 83 (2007): 141-178.
[3] Furst, Eric M., and Todd M. Squires. *Microrheology*. Oxford University Press, 2017.