Technology from Kyoto University

Novel Method for Quantifying Genetic Mutations in Live Cells

We are looking to out-license the technology for its commercialization.

Enables quantitative evaluation of cancer-associated genetic mutations based on cell imaging

◆Background

Cancer arises from genetic mutations, yet even cells with identical genomes can progress differently due to phenotypic variations such as morphology, growth rate, and gene expression. This has increased interest in multi-omics and mechanobiology. However, conventional methods rely on fixed, stained samples, limiting dynamic analysis. **Quantitative evaluation of living cells and organoids** is therefore essential for advanced and personalized medicine.

◆Description

Kyoto University researchers used time-lapse imaging of patient-derived colorectal cancer organoids to analyze deformation during cell division, finding it varies with cancer-related gene mutations (Fig.1). A mathematical model established based on the finding enabled derivation of mechanical properties and quantitative evaluation of these mutations (Fig.2). This technology enables quantitative detection of drug-induced phenotypic changes (Fig.3) and has potential applications in early detection of poor-prognosis mutations, as well as in assessing dose-and irradiation time-dependent responses to inhibitors and radiation.

- **Non-invasive evaluation of living cells**

  Non-invasive and stain-free, this technology can be applied alongside organoid culture.

- **Analysis based solely on imaging data during cell culture**

  Quantifying mechanical properties from time-lapse imaging data enables evaluation of molecular-level alterations.

- **Potential applications in drug efficacy evaluation and personalized medicine**

  Drug responses in living cells correlate with gene expression levels.

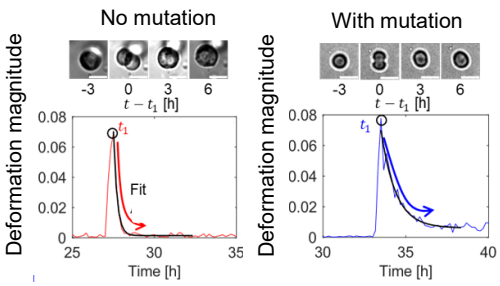

Fig. 1: Deformation during cell division and recovery, depending on genetic mutation status
Cells with genetic mutations were found to take longer to recover their original shape after deformation.

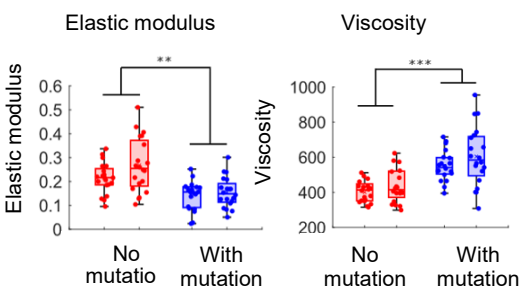

Fig. 2: Differences in elastic modulus and viscosity by genetic mutation status
Viscoelastic analysis of living cells using this technology showed that cells with genetic mutations have lower elastic modulus and higher viscosity. (** p< 0.01 *** p< 0.001)

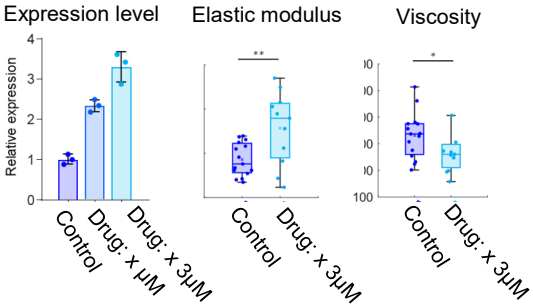

Fig. 3: Quantitative evaluation of drug effects
The same mutant cells as in Fig. 2 were treated with a drug, and gene expression, elasticity, and viscosity were assessed. Treatment increased elasticity and gene expression while decreasing viscosity, indicating a clear drug effect compared to the untreated condition.

◆Journal Publication

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◆Applications

- Mechanobiology
- Cell dynamics evaluation
- Drug efficacy testing
- Personalized cancer medicine
- Cell analysis systems (e.g., microscopes, software)

◆Offer

- Patent License
- Option for Patent License
- Collaborative Research

◆Contact

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