Docket #: S18-227

Microfluidic guillotine for splitting cellular structures

Running chemotherapeutic drug screens on tumor biopsies ex vivo has the potential to increase patient survival by personally matching them to the drug which is the most effective against their particular tumor. We have developed a robust microfluidics-based method of quickly splitting tumor biopsies into thousands of uniform-size fragments between 10 and 100 ?m in diameter. These fragments can then be loaded into a multi-well plate format to test the effectiveness of different drugs on causing cancer cell death. This method has superior reproducibility and uniformity of fragment size compared to centrifugation to produce fragments and does not require enzymes which break apart cell-cell adhesions, disrupting the tumor microenvironment.

Figure

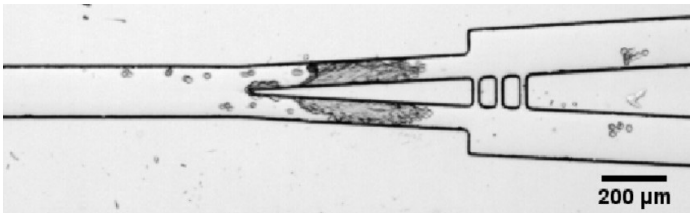

Figure description - Image of a spheroid cleaved using the microfluidic guillotine.

Stage of Research

- Prototype completed using various spheroids
- Cell viability tested and optimized

Applications

- Splitting of tissue biopsies into multiple micro-sections of the same size for further analysis, such as personalized chemotherapeutic drug panel screening

- Bisection of single cells, multicellular structures (e.g. organoids or tissue samples), or multicellular organisms (e.g. Planaria or Drosophila)

Advantages

- **Uniform-size tissue fragments** - Fragments down to 10 – 100 ?m in diameter, 10-15% uniformity between individual fragments
- **True tumor microenvironment** - No need to use enzymes which break apart cell-cell adhesions and disrupt extracellular matrix
- **High-throughput and fast** - Generation of hundreds or thousands of fragments for drug screening within a few minutes, Ability to test hundreds or thousands of drug combinations and/or tumor heterogeneity
- **Low cell wounding** - Bisected organoids able to regenerate programmed structure *(Science 2018)*, Single cells have 95% survival after bisection *(PNAS 2017)*

Publications

- Blauch, L. R., Gai, Y., Khor, J. W., Sood, P., Marshall, W. F., & Tang, S. K." Microfluidic guillotine for single-cell wound repair studies,"Proceedings of the National Academy of Sciences, 114(28), 7283-7288. doi:10.1073/pnas.1705059114
- Toda, S., Blauch, L. R., Tang, S. K., Morsut, L., & Lim, W. A."Programming self-organizing multicellular structures with synthetic cell-cell signaling," Science. doi:10.1126/science.aat0271

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