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Chips and Fabrication Methods for Capture and Rotation of Live Single Cells or Cell Clusters

High-dimensional single cell visualization technologies, such as live-cell computed tomography (CT), are redefining the way we view and understand biological systems, particularly when identifying and analyzing cancer cells. Some cell defects on the surface or in the interior of a cell just can't be properly evaluated in two dimensional microscopy. However, to completely visualize and quantitatively image single cells or cell clusters, the cell/cells needs to be rotated slowly enough to allow low light-level data acquisition.

Researchers at the Biodesign Institute of Arizona State University have developed novel fabrication methods and systems for creating an electrocage chip that allows for the rotation of live single cells. The fabrication techniques allow for creating simpler designs which are easier and cheaper to make. The chips are also stronger and have more precise alignment. Additionally, a modified cellular growth medium was developed to suspend cells and allow for the acquisition of images suitable for tomographic reconstruction using a cell-rotating electrocage device.

These chips and fabrication methods provide a novel and efficient means to produce devices to capture three dimensional images of live/fixed cells, cell clusters or particles.

Potential Applications

- Rotation and 3D visualization of the entire surface of live or fixed cells/cell clusters/particles
  - Cancer cell identification and analysis
  - Studying disease progression, development, treatment and prognosis
  - Investigating disease models
  - mRNA/cell stress analyses

Benefits and Advantages

- The fabrication technique permits simpler design and easier/cheaper fabrication
  - The high strength and consistency of the fabrication techniques allows for greater freedom in design of channels and other microfeatures
  - Designs can be of much higher tolerance because of more increased precision in alignment
- Novel cellular growth medium allows for image acquisition suitable for tomographic reconstruction
  - Lower angular velocity and higher lateral stability rotation of cells, cell clusters or particles compared to regular growth medium
  - Longer detector integration times and efficient use of frame rate for

improved image reconstruction as well as decreased distortion and blur degradation

- Higher signal-to-noise ratios

For more information about the inventor(s) and their research, please see Dr. Meldrum's directory webpageDr. Meldrum's Biodesign directory webpage