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A high-throughput three-dimensional cell migration assay for toxicity screening with mobile device-based macroscopic image analysis

SUBJECT AREAS:
BIOLOGICAL MODELS
TOXICOLOGY
CELL MIGRATION
ASSAY SYSTEMS

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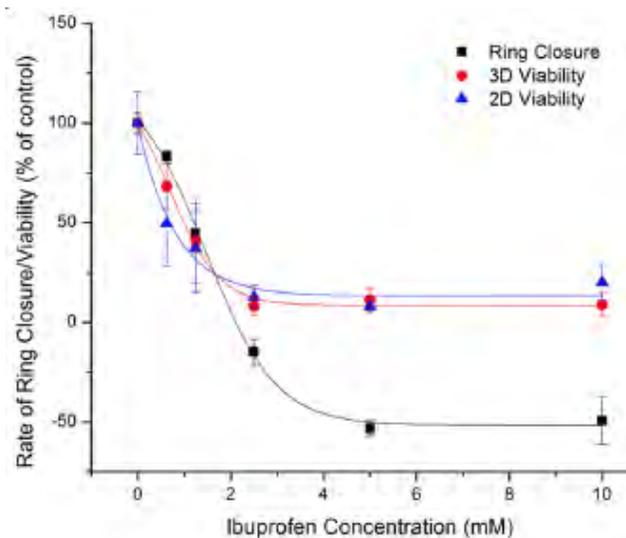
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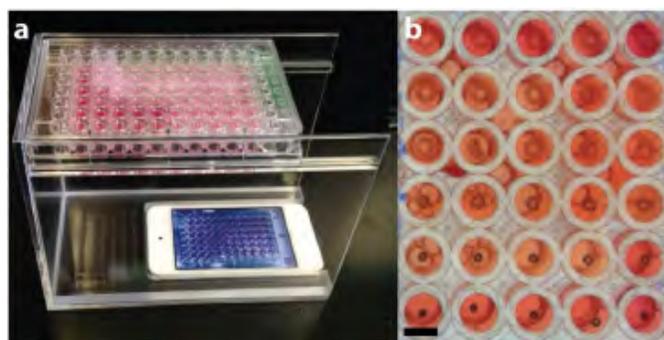
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Abstract: There is a growing demand for in vitro assays for toxicity screening in three-dimensional (3D) environments. In this study, 3D cell culture using magnetic levitation was used to create an assay in which cells were patterned into 3D rings that close over time. The rate of closure was determined from time-lapse images taken with a mobile device and related to drug concentration.



Dose Response: Dose response curves of the BiO Assay versus the CellTiter-Blue assay performed on 2D and 3D cultures of HEK293 exposed to ibuprofen. All rates were normalized to control, and error bars represent standard deviation.



BiO Assay: iPod imaging setup (a) and the resulting rings of HEK293s exposed to ibuprofen captured with the iPod. The BiO Assay setup is compact, and can fit within most standard incubators. Researchers can program the iPod, which has sufficient camera resolution, to image whole plates at specific times, forgoing the need to go under the microscope at regular intervals. Note the resolution and contrast of the rings in the image taken by the iPod. Scale bar = 5 mm.

Rings of human embryonic kidney cells (HEK293) and tracheal smooth muscle cells (SMCs) were tested with ibuprofen and sodium dodecyl sulfate (SDS). Ring closure correlated with the viability and migration of cells in two dimensions (2D). Images taken using a mobile device were similar in analysis to images taken with a microscope. Ring closure may serve as a promising label-free and quantitative assay for high-throughput in vivo toxicity in 3D cultures.

- **BiO Assay combines the in vivo-like environment of 3D cultures, with a simple, real-time, and quantitative metric**
- **The iPod system improves throughput and efficiency**



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