Microwell Moat Prevents Spillover

Published date: March 14, 2017

Technology description

The ability to study single cells has become indispensable, helping researchers identify characteristics and behaviors otherwise hidden using population averages. By obtaining multiple measures per cell, researchers can compare cellular characteristics within a single experiment. This addresses a fundamental challenge in nearly all areas of biology. Such single-cell experiments are especially helpful for studying virus-host interactions because different cells respond differently to infection and therapies.

Many single-cell techniques have been developed, but devices called microwells are especially attractive for their ease of operation, throughput and low cost. These flat devices are checkered with tiny wells that isolate analytes and cells. The design allows the microwells to be sealed using a lid for complete single-cell isolation. A critical benefit of microwells is the ability to use the location of the well to keep track of each cell’ s information. Furthermore, the small volumes of the microwells are cost effective and enable assays that are about 40 times more sensitive.

Until now, microwells allowed only a single experimental condition to be examined per chip, making it difficult to control for chip-to-chip variation. Also, the process of loading and treating the microwells has been tough to standardize and automate for widespread use in standard biology labs or screening facilities. UW–Madison researchers have developed a new microwell design for use with conventional micropipetting equipment (e.g., a hand-held micropipette or automated pipetting robot). Similar to other microwell designs, the flat device is checkered with nanoliter microwells. However, in the new design, groups of microwells are ringed by deeper moat-like channels that isolate the groups and prevent any spillover when a fluid droplet, e.g., a reagent or cell suspension, is deposited. The moat also keeps fluid from being ‘squished’ and spread out when a when a lid is applied to seal each microwell, avoiding cross-contamination of each experimental condition.

The design enables multiple different reagents/experimental conditions to be tested on the same device using standard pipetting operations. Together, the new features enable easier, more robust, quantitative and massively parallelized single-cell assays for a range of endpoints that can interface with standard pipette equipment.

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a microfluidic plate design that isolates groups of microwells and simplifies pipette-based, single-cell experimentation.

Additional Information

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WARF reference number P100069US01 describes a microfluidic device for concentrating rare cells.
http://www.warf.org/technologies/summary/P100069US01.cmsx

Application area

Studying infections of single cells with single virus particles
Implications for drug design, screening, general cell biology and virology

Advantages

Easy to make and use
Inexpensive
Reduces contamination
Can be used with conventional micropipetting

Institution

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