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Computer vision to rapidly sort and analyse cells

Accelerating the drug discovery and development process, Bioelectronica has developed Hypercell, a digital biochemistry integrated single-cell identification and sorting system offering superior output.

Antibodies are improving the lives of people with previously unmet medical needs and generating blockbuster sales. Yet, the progress of breakthrough antibodies is being held up by low-throughput cell identification and sorting methods. Recognizing the bottleneck, Bioelectronica is using computer vision single-cell sorting (CVSCS) to achieve 20-fold time savings.

Today, researchers use microwell plates or fluorescence-activated cell sorting (FACS) to screen for cells that secrete antibodies. However, FACS has two significant limitations, namely, that it has limited throughput and that it detects cell surface markers, not secreted proteins. Similarly, incubating cells in microliter volumes requires significant time to accumulate sufficient antibody concentration to detect the titer. These limitations force companies to search for a needle in a haystack using a tool ill-suited to working at such scales.

Bioelectronica is freeing drug developers from those constraints. Roger Chen, who founded DNA sequencing company Genia Technologies and helped lead it to a takeover by Roche, and Jonathan Hull cofounded Bioelectronica to apply scalable engineering principles to biochemical research. The result is Hypercell, a high-throughput digital biochemistry platform that is being applied to single-cell analysis and sorting.

How Hypercell works

Hypercell is the first example of CVSCS. In tasking a computer with tracking cells moving through a channel, Bioelectronica has created a lensless imaging technology capable of monitoring many millions of cells. The system uses patented 'electrofluidics' technology to sort cells and isolate those the computer vision determines to be a 'hit'. In this way, Hypercell is an integrated single-cell identification and sorting system with superior throughput (Fig. 1).

Bioelectronica has paired the vision capabilities to enough computing power to quickly analyze vast numbers of cells, helping Hypercell to detect and isolate high-secreting cells in a few hours, instead of the days it takes when working with microwell plates.

The final enabling technology is a unique approach to small-volume manipulation and measurement. Using electrodes, Hypercell steers cells as they move through the system, equipping Bioelectronica to separate off the most promising prospects for recovery, gene sequence analysis, cloning and the next stages of drug discovery.

Bioelectronica's technology is scalable by design because the electrofluidic chips are printed using roll-to-roll manufacturing techniques, facilitating a massively parallel approach to sorting. Working with hundreds of parallel channels enables Bioelectronica to raise throughput without subjecting cells to flow rates high enough to cause shear damage.

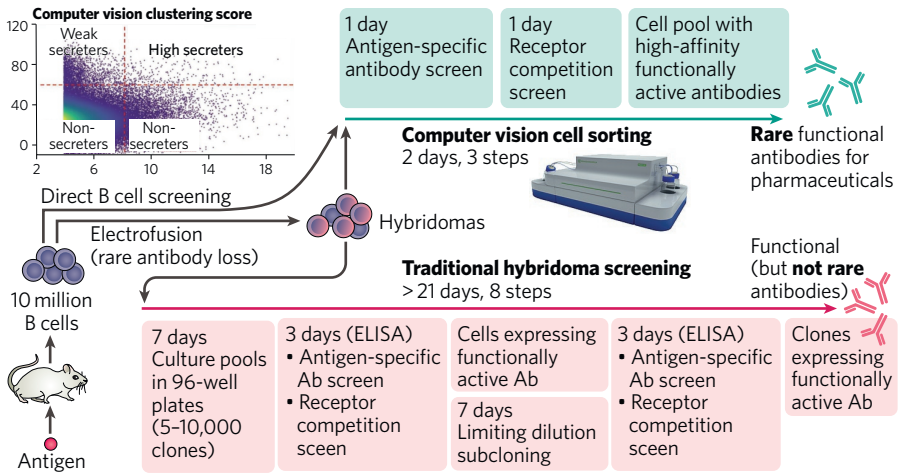

Fig. 1 | Bioelectronica's Hypercell technology. The technology saves a significant amount of time, sorting cells in days instead of weeks.

Hypercell is being used with hybridomas, primary B, CHO and HEK 293 cells, and Bioelectronica has a development roadmap featuring assays for T cells, cell therapy and other applications. Across that wide range of uses, the power of the technology is perhaps best illustrated by its application to direct B cell screening.

Direct B cell screening is a particularly popular application because Hypercell's throughput and speed overcome traditional limitations in working with these cells. The instability of B cells has traditionally forced researchers to fuse them with other cells to form hybridomas. That gets around the stability issue, but causes the loss of 70–90% of available B cells. It can take researchers 3 weeks to generate functional leads using the hybridoma approach.

Direct B cell screening with Hypercell eliminates the wasteful and time-consuming steps of the hybridoma process. As Hypercell works at a throughput and speed far beyond those of conventional approaches, it is possible to directly screen B cells. Direct screening shortens the time to leads from 3 weeks to 1–2 days and avoids the loss of B cells inherent in the hybridoma approach.

Accessing the technology

New applications of Hypercell, such as direct B cell screening, have attracted the attention of Big Pharma companies, while contract research organizations (CROs), contract development and manufacturing organizations (CDMOs) and smaller companies appreciate the price point and partnership opportunities that do not require large upfront cost commitments. Bioelectronica is selling Hypercell to select partners for use in their own laboratories. Because of demand, the company has also begun a contract service offering.

To support its competitively priced service offering, Bioelectronica has established wet labs capable of handling work such as applications development, sorting and cell culture. Drug developers can outsource antibody discovery and other activities to Bioelectronica, empowering them to advance programs virtually and access extra capacity to take on new projects. The contract antibody discovery service is running during the COVID-19 pandemic.

Bioelectronica is scaling up its operation but, having attracted interest from Big Pharma, it has limited spare supply for 2020. Companies interested in joining the early access program or outsourcing work to Bioelectronica should move quickly.

Drug developers that avail themselves of the services offered by Bioelectronica stand to reap major benefits. In working with a partner that radically improves cell screening, biopharma companies can build more robust pipelines, perform more thorough analysis and expand their intellectual property, all while spending less and moving more quickly than is possible using older technologies.

CONTACT
Jonathan Hull, VP
Bioelectronica
Reno, NV, USA
Tel: +1-347-878-5859
Email: jonathan@bioelectronica.com