

Microparticle encoding advances multiplexing

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TODAY, MANY COMPANIES OFFER WELL-ESTABLISHED, PARALLEL TESTING technologies such as ELISAs, 2D gels and microarrays. Such solutions tend to be labour-intensive and relatively wasteful in terms of the amount of samples and reagents used. In their drive to reduce R&D expenses and time to market, pharmaceutical and diagnostics companies are increasingly searching for powerful, cost-efficient tools that enable them to extract more information from each assay sample. One way of improving productivity is to carry out multiple assays simultaneously — so-called multiplexing.

Encoding improves results

Over the past few years, companies such as Luminex, Illumina, Nanoplex, Quantum Dot, Pharmaseq and SmartBead have begun developing multiplexing solutions based on microparticle array technologies. Such solutions have broad applications and promise significantly improved productivity across drug discovery, screening, diagnostics and the life sciences in general.

A common feature of recent microparticle array solutions is that individual test compounds are tagged with encoded microparticles so that multiple tests may be tracked and analysed simultaneously in a single vessel. The decoding of the microparticles reveals the identities of the tagged compounds and, depending on the test, the amount of captured analyte. The key benefit of these solutions is that more information is generated from each test sample, which results in decreased usage of labour and reagents.

Protein microarrays

In contrast to the extensive use of microarrays for DNA-based applications, the use of protein microarrays is still in its infancy, notable exceptions being products from CIPHERGEN and ZYOMYX. *In vivo*, proteins function in solution or as components of microscale structures. As far as practicable, the *in vivo* environment needs to be reproduced to generate meaningful assay data.

2D microarray platforms introduce measurement uncertainties relating to the distribution of reagents over surfaces and the flow properties at the solid/liquid interface. 3D microparticle arrays can potentially overcome these problems since microparticles suspended in solution do not compromise the kinetics of protein binding. Also, since each element of a microparticle array is independent, the system has the flexibility to interrogate up to

thousands of proteins without needing a new chip with a customised set of elements.

Choosing a method

Leaving aside materials and other physical properties such as size and shape, a key differentiator for each proprietary microparticle is the encoding method employed. These methods can, broadly, be classified as follows:

- ♦ **Spectrometrically encoded microparticles.** These microparticles use spectrometric chemical tags or are optically encoded. They are decoded by being placed directly into a spectrometer, where the absorption or emission spectrum of the microparticle determines its identity. Used by, for example, Luminex, Illumina and Quantum Dot.
- ♦ **Electronically encoded microparticles.** These microparticles are identified through their transmission of radio frequency codes. Used by, for example, Pharmaseq.
- ♦ **Graphically encoded microparticles.** These microparticles are physically encoded and are identified by the differential contrast of their 2D code components. Used by, for example, Nanoplex and SmartBead.

When choosing between microparticle platforms, there are many questions that potential users need to ask themselves. How many unique codes can be generated in practice? Is the encoding method scalable for future multiplexing applications? Does the platform offer true flexibility? How will the technology integrate with existing systems and work practices? Is the overall concept simple or complex? A simple microparticle array technology is more likely to represent a genuine economic benefit and, hence, be widely adopted.

Next-generation multiplexing

Future multiplexing solutions are likely to combine encoded microparticles with existing microarray technologies. This will result in increased multiplexing capabilities, higher throughput, further reductions in the volume of reagents used and new ways of multiplexing. ■■■

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