



Nano interactions: overcoming limitations in nanoparticle safety testing using real time measurements

As nanotechnologies become incorporated into more and more commercial products, it is increasingly important to understand the potential risk they pose to human health. In response to this worldwide need, LGC is developing new *in vitro* testing regimes which can overcome the potentially misleading results obtained from traditional toxicity assays.



The Requirement

Nanomaterials are now incorporated into more than 800 commercial products accounting for over £104 billion in sales worldwide. These products impact on every aspect of human life – from paints that stop corrosion, to stain resistant fabrics and nanotechnology-driven catalysts for fuel cells. They are even incorporated into sun creams and antibacterial socks. The increased use of nanotechnologies is driven by the unique mechanical, thermal and catalytic properties that materials develop when structured at the nanoscale. These unique properties, while beneficial for technological innovation, could also make nanomaterials toxic to biological tissues, raising concern they could pose a risk to human health. However, while methodologies have been developed to test chemicals for toxicity, there are currently no standardised methods to measure the toxic effects of nanoparticles.

The Solution

Standardisation has become a major issue for nano-toxicologists due to the inconsistent behaviours displayed by nanoparticles in traditional *in vitro* screening models, and by the variability in experimental methods employed by different laboratories. While high throughput *in vitro* screening regimes can offer rapid analysis of nanomaterial interactions at the cellular level, nanomaterials can potentially interact with soluble assay reagents, providing misleading results. To overcome this, LGC is validating a label free, real time, cell electronic sensing system (xCELLigence) to measure changes in cell number following nanoparticle exposure. This technique enables continual analysis of the cells using electrical impedance measurements and provides quantitative information about the rates and mechanisms of toxicity which can be missed when using traditional assays.

The Implementation

Using this technology, LGC has been able to demonstrate reproducible toxicity measurements in a range of cell lines using a panel of nanoparticles with different chemical properties. Unlike traditional toxicity assays, which were run as a direct comparison, the xCELLigence system was shown not to be susceptible to measurement interference by the nanoparticles allowing the relationship between toxic response in the cells and nanoparticle composition to be measured. Importantly, the real time capability has enabled LGC scientists to uncover unique biological responses that cells undergo immediately following nanoparticle exposure; these responses are missed in traditional assays. Validation of this technology opens up the real possibility of developing standardised high throughput testing regimes for nanotoxicity measurement.

Impact

LGC is using its expertise in *in vitro* toxicology assays to validate xCELLigence as an alternative to traditional assays for nanotoxicity testing. This approach further develops standardised methods that can be used to improve the accuracy of *in vitro* data and allow a more realistic prediction of *in vivo* nanotoxicology.

Chris Bullion, Technical Representative for Roche Diagnostics Limited, developers of xCELLigence says “LGC’s real time nanoparticle toxicity measurements really demonstrate the versatile capabilities of xCELLigence and its potential for the provision of safety assurance in an emerging field”.

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