High Throughput Nanoparticle Cell Interaction Microscopy

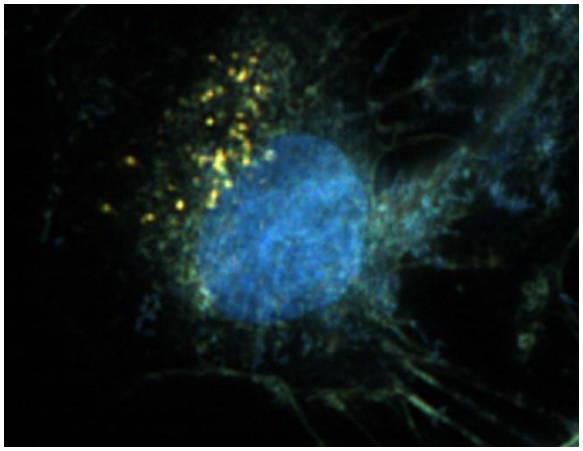

Figure 1: Unlabeled AuNPs Aggregating in DAPI Stained Cell

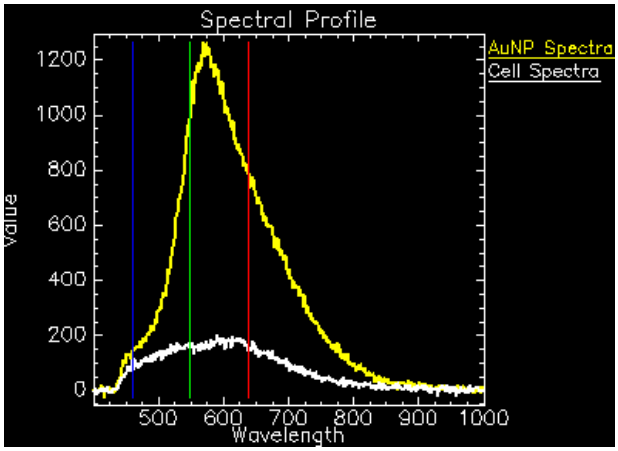

Figure 2: Spectral Response of AuNPs vs Non-stained Cell Area

The ability to quickly observe and confirm nanoparticle cell interaction over a large number of samples is a critical aspect of effective nanoparticle theranostic research. The impact of changing variables, such as nanoparticle size, concentration or targeting proteins, is much easier to understand when you can easily image the results of these changes in the cell or tissue culture.

Established imaging techniques such as energy dispersive x-ray spectroscopy and scanning electron microscopy (EDX SEM) and Raman microscopy can provide important quantitative insight for these types of samples. However, these techniques, operationally, are very time consuming and low throughput by nature. As a result, CytoViva's enhanced darkfield optical and hyperspectral microscopy is fast developing as the method to help overcome the time and sample volume limitations of both EDX SEM and Raman microscopy.

CytoViva's enhanced darkfield optical and hyperspectral microscopy system provides the ability to optically image and spectrally confirm the presence of unlabeled nanoparticles in both fluorescently labeled and non-labeled cells in a high throughput manner. With this technique, a sample can be optically observed and captured in seconds as demonstrated in Figure 1 above which shows unlabeled AuNPs (gold or yellow) aggregating in a cell around a DAPI stained (blue) nucleus. CytoViva's enhanced darkfield microscopy produces very high signal to noise images of nanoscale elements in many different environments. Published results demonstrate that CytoViva's patented enhanced darkfield optics produce up to a tenfold increase in signal to noise of nanoparticle scatter over standard darkfield microscopy optics[1]. This increased performance not only improves the ability to observe nanoparticle scatter, it is faster and easier to use than standard darkfield optics.

Enhanced darkfield hyperspectral images can be captured with this technique in just a few minutes. These hyperspectral images provide a spectral response of every nanoscale pixel of the image enabling the ability to spectrally confirm and spectrally map nanoparticles versus cell structure based on their unique scatter or emission properties (see Figure 2 above as an example of spectral response from a single pixel AuNP scatter in the cell along with example cell structure spectra). The accuracy of CytoViva's hyperspectral imaging and mapping of nanoparticles in biological matrixes has been cross validated against highly quantitative techniques including EDX SEM and Raman microscopy[2].

References

1. *Peng Zhang, Sangyoon Park, and Seong Ho Kang (2015) Microchip Electrophoresis with Enhanced Dark-Field Illumination Detection for Fast Separation of Native Single Super-Paramagnetic Nanoparticles BULLETIN OF THE KOREAN CHEMICAL SOCIETY DOI: 10.1002/bkcs.10219*
2. *MARIA DEL PILAR SOSA PE NA, ABHISHEK GOTTIPATI, SAHIL TAHILIANI, NICOLE M. NEU-BAKER,MARY D. FRAME, ADAM J. FRIEDMAN AND SARA A. BRENNER Hyperspectral Imaging of Nanoparticles in Biological Samples: Simultaneous Visualization and Elemental Identification MICROSCOPY RESEARCH AND TECHNIQUE 00:00-00 (2016)*

More Information

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