Hyperspectral Microscopy Cross-Validated with Electron Microscopy and Raman Spectroscopy

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Recently published results in Microscopy Research and Techniquehttp://www.ncbi.nlm.nih.gov/pubmed/26864497 have demonstrated the accuracy of CytoViva's enhanced darkfield hyperspectral microscopy, by comparing its performance against scanning electron microscopy and energy dispersive X-ray spectroscopy (SEM-EDS) and Raman spectroscopy[1]. This work was conducted by the Brenner Research Group at State University of New York (SUNY) Polytechnic Institute, Colleges of Nanoscale Science and Engineering.

This research utilized porcine skin tissue sections exposed to unlabeled nanomaterials including alumina, silica and ceria. In Figure 1 below, example images and hyperspectral mapping illustrations of nanoparticles in the tissue are shown. These are representative images published in a prior open source paper on enhanced darkfield hyperspectral microscopy in the Journal of Visualized Experiments (JOVE)[2]. http://www.jove.com/video/53317/identification-metal-oxide-nanoparticles-histological-samples.

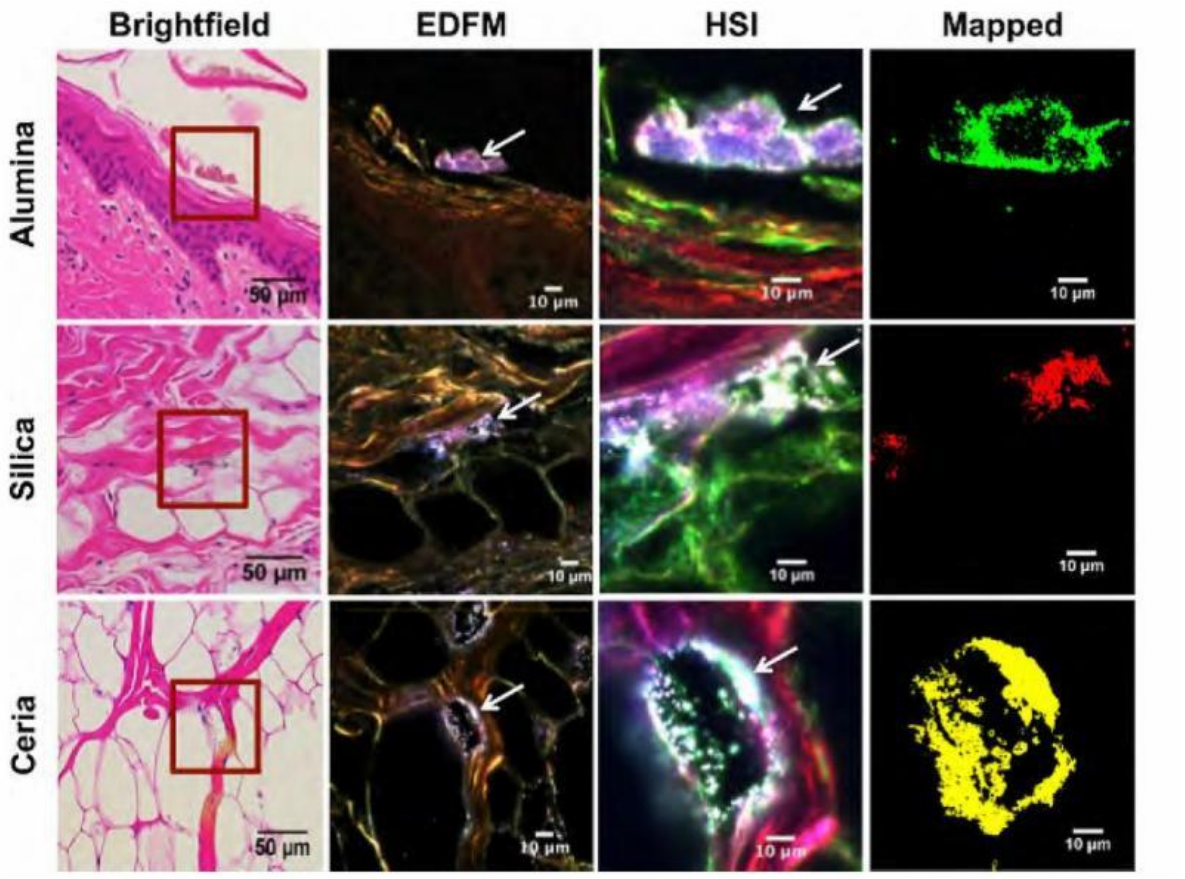

Figure 1: Brightfield, enhanced darkfield and hyperspectral microscope images of porcine skin tissue exposed to different unlabeled nanomaterials. The images in the far right column (mapped) represent hyperspectral mapping of the nanomaterials in the tissue.

The presence of the unlabeled nanomaterials in the tissue was cross-validated by SEM-EDS and Raman spectroscopy techniques. While these technologies provide advantages that include high image resolution and/or elemental analysis quantification, the Microscopy Research and Technique paper notes that enhanced darkfield hyperspectral microscopy can provide significant time and cost efficiencies over these techniques. One example in the paper detailed the ability to conduct imaging and analysis of a 1.5cm x 1.5cm tissue section in one day with the CytoViva technique, while electron microscopy imaging and analysis of comparable area would potentially require months to complete. Additionally, the paper outlined

significant advantages regarding operational ease of use of the enhanced darkfield hyperspectral microscope system versus these other techniques.

These published results demonstrate that enhanced darkfield hyperspectral microscopy can provide significant efficiencies and serve as a primary methodology for accurately identifying and mapping unlabeled nanomaterials in complex matrices. This data can then be successfully cross-validated with slower, more expensive and more complex methods that provide elemental analysis and or higher spatial resolution imagery.

To learn more about CytoViva's Enhanced Darkfield Hyperspectral Microscopy, contact us at info@cytoviva.com or 1.888.737.3130. We would be pleased to learn more about your current research and can schedule test imaging of your samples if appropriate.

References

[1] *Peña MD, Gottipati A, Tahiliani S, Neu-Baker NM, Frame MD, Friedman AJ, Brenner SA Hyperspectral imaging of nanoparticles in biological samples: Simultaneous visualization and elemental identification Microsc Res Tech. 2016 Feb 11. doi: 10.1002/jemt.22637*

[2] *Roth, G.A., Sosa Peña, M.d.P., Neu-Baker, N.M., Tahiliani, S., Brenner, S.A. Identification of Metal Oxide Nanoparticles in Histological Samples by Enhanced Darkfield Microscopy and Hyperspectral Mapping. J. Vis. Exp. (106), e53317, doi:10.3791/53317 (2015)*