Quantitative Quantum Dot Identification

CytoViva® Illuminating the Future

While quantum dots (QDs) are being used to improve the performance of Liquid Crystal Displays (LCDs) in smart phones and televisions, their utility extends far beyond improving our viewing experience. These semiconducting particles, which are nanometers in size, very efficiently emit light energy in narrow color bands and can be excited with little photobleaching. The high surface-to-area ratio of QDs presents many application opportunities, and the unique optoelectronic properties of QDs allow for precise tuning of the emission through modification of the size, shape, and composition. These versatile particles have been investigated for their use in biosensors, electronics, catalysts, nanomedicine, and bioimaging.

Using CytoViva enhanced darkfield illumination integrated with hyperspectral imaging, we have successfully identified the presence of QDs both visually and spectrally in retinal tissue (**Fig. 1**). While we can easily visualize the red emission from the QDs, hyperspectral imaging allows for quantitative measurement of the QD emission. In this case, the emission was measured at 628 nm. This technique has an advantage over confocal microscopy because the QDs can be simultaneously visualized (**Fig. 1A**) and spectrally corroborated (**Fig. 1B**) in the context of the tissue (or other matrix) without the use of fluorophores.

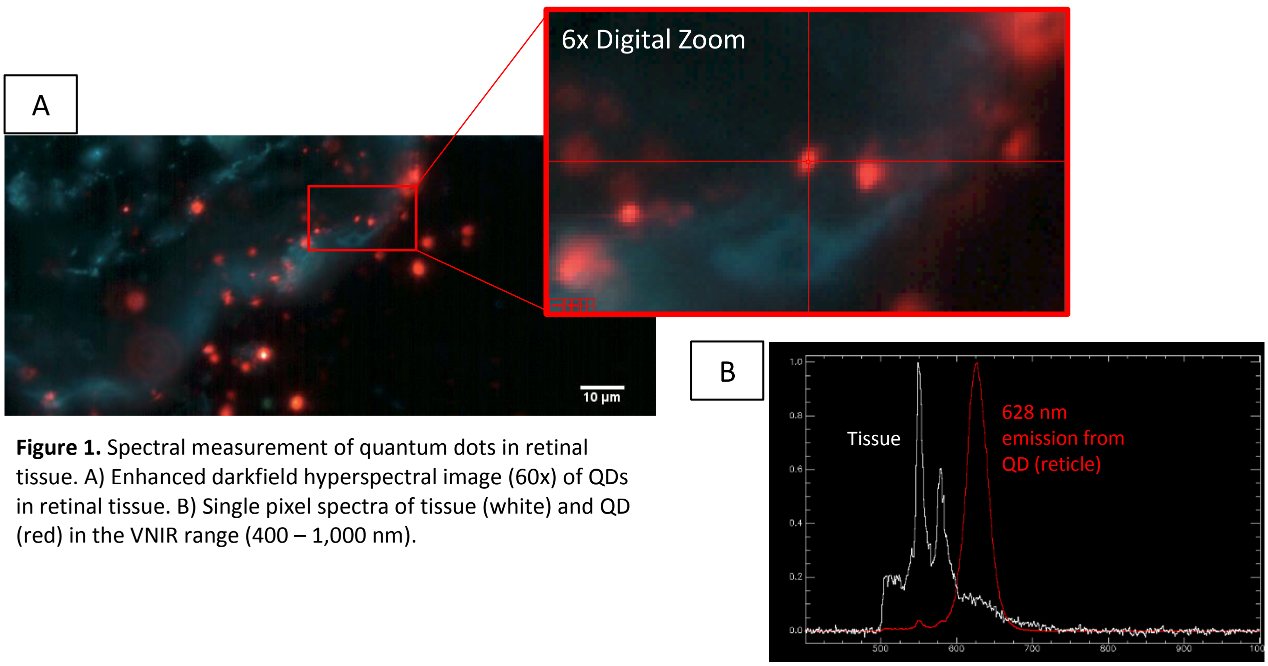

Figure 1. Spectral measurement of quantum dots in retinal tissue. A) Enhanced darkfield hyperspectral image (60x) of QDs in retinal tissue. B) Single pixel spectra of tissue (white) and QD (red) in the VNIR range (400 – 1,000 nm).

In the realm of materials science, CytoViva enhanced darkfield hyperspectral microscopy can be used to identify QDs on substrates. In **Fig. 2**, gold nanoparticles (AuNPs) and QDs were identified and differentiated within a polyester fiber. While we can visualize the nanoparticles embedded in the fiber, we cannot be certain of the nature of the nanoparticles without quantitative confirmation. In a matter of minutes, we acquired a hyperspectral image (**Fig. 2A**) and determined the identity of the particles from the spectral data (**Fig. 2B**).

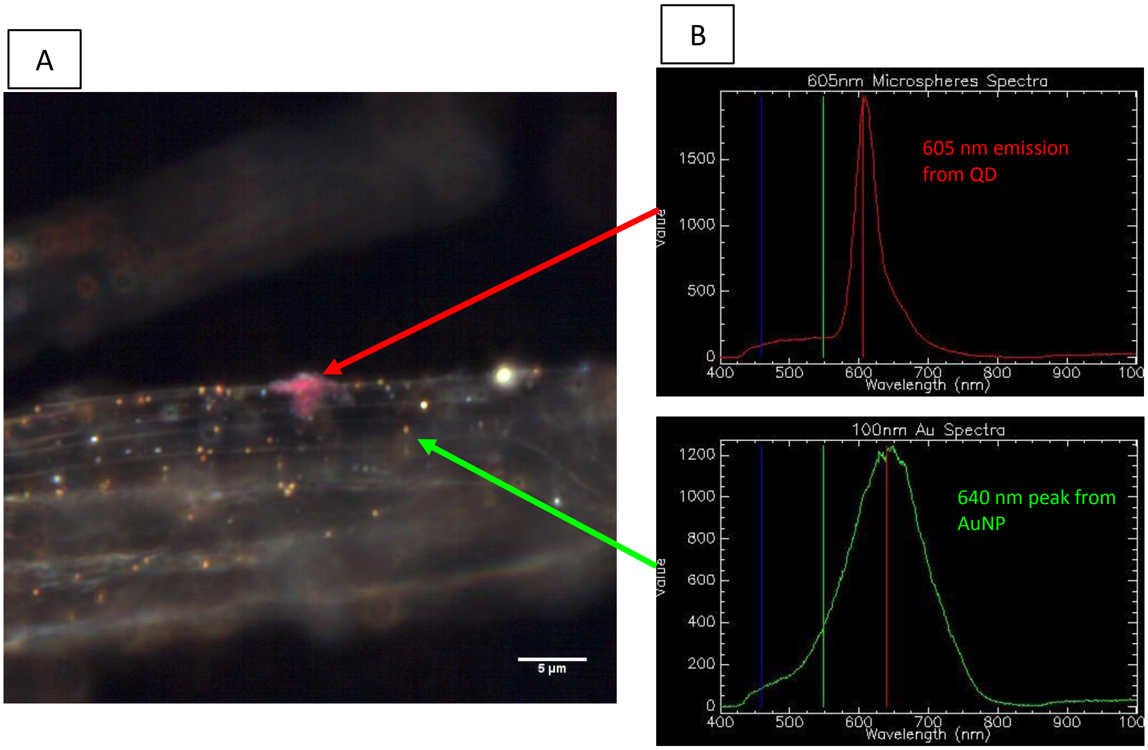

Figure 2. Spectral differentiation of QDs and AuNPs embedded in polyester fiber. A) Enhanced darkfield hyperspectral image (40x) of AuNPs and QDs in polyester fiber. B) Single pixel spectra of QD (red) and AuNP (green) in the VNIR range (400 – 1,000 nm).

Whether you are working with QDs or other nanoscale particles in biological or material matrices, CytoViva enhanced darkfield hyperspectral microscopy can accelerate your research through quick, quantitative data acquisition and minimal sample preparation. Please contact us at info@cytoviva.com to learn more about the technique or to discuss test imaging of your samples.