Plasmonic Nanorod Hyperspectral Imaging for Photothermal Therapy

By synthesizing plasmonic nanorods to specific length and width geometries (aspect ratios), it is possible to precisely control the wavelengths at which they absorb and reflect visible and NIR light. This creates great potential for applications in areas such as photothermal therapy. This exciting area of research involves the uptake of nanorods by targeted cells. These nanorod laden cells are then exposed to laser light at specific wavelengths. The laser causes heating of the nanorod loaded cells, inducing apoptosis, while minimizing the effect to surrounding non targeted cells and tissue.

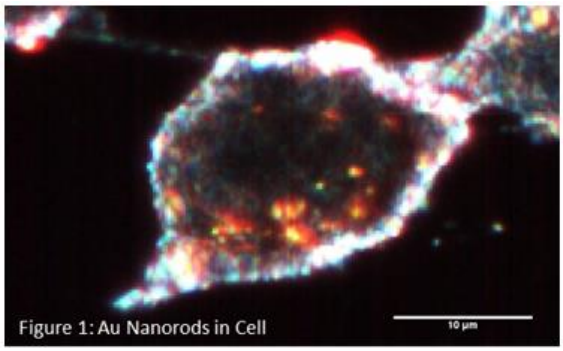

Figure 1: Au Nanorods in Cell

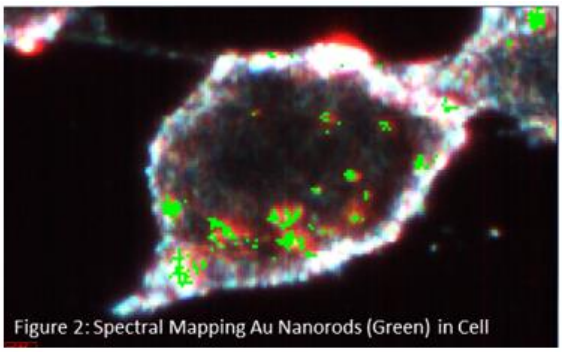
Figure 2: Spectral Mapping Au Nanorods (Green) in Cell

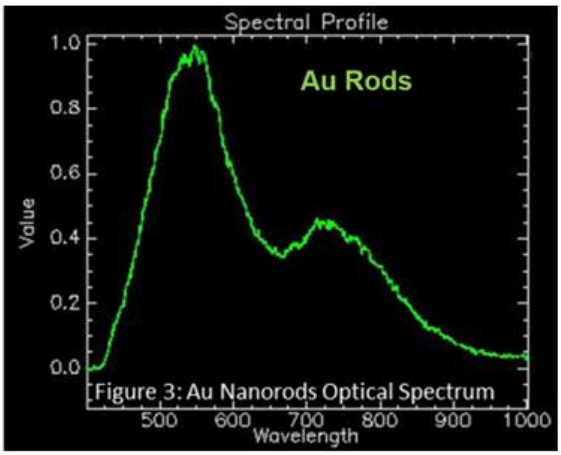

Figure 3: Au Nanorods Optical Spectrum

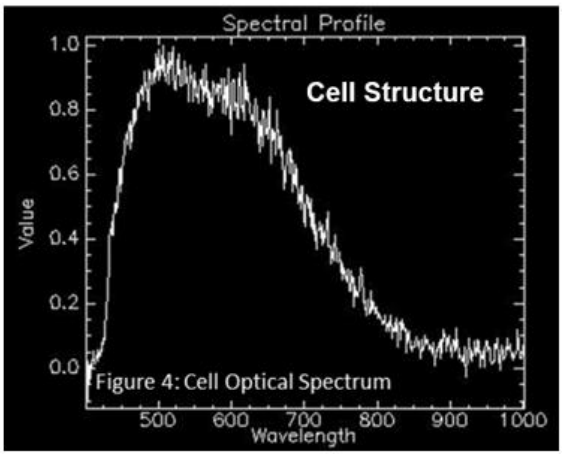

Figure 4: Cell Optical Spectrum

Testing the efficacy of these nanorods for photothermal and related applications requires a reliable method for rapidly observing and spectrally characterizing the nanomaterials in cells and tissue. CytoViva's Enhanced Darkfield Hyperspectral Microscopy System is an established standard to support this research. The example images and spectral data above demonstrate these abilities.

Figure 1 above is an enhanced darkfield hyperspectral image of cells with internalized Au nanorods. These nanorods appear orange or red when imaged with full spectrum light due to their plasmonic properties. Note that fluorescent labeling is not required for observing either the cell or nanorod structures with this technique.

Figure 2 illustrates spectral mapping (in green) of every pixel in the hyperspectral image that contains the unique spectral response of the Au nanorods. Figure 3 illustrates the spectral response of individual Au nanorods in the cell along with figure 4 showing the comparative spectral response of the cell structure. This spectral response is present and can be measured from each pixel of the hyperspectral image. Note the aspect ratio of these nanorods causes them to produce an optical spectral response peak at 550nm with a distinct shoulder at 750nm. This is highly consistent for each nanorod throughout the sample.

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In addition to plasmonic nanomaterials, CytoViva technology is used to spectrally identify a wide range of nano scale materials in both biological and materials based matrices. This includes metal oxide, carbon, and lipid based nanomaterials. It is also used to observe and spectrally characterize fluorescent or photoluminescence materials such as quantum dots and dyes. Multiple peer-reviewed methods publications exist illustrating the system with each of these different types of nanomaterials.

Please select the Google Scholar link below to review these publications:
Google Scholar - CytoViva Hyperspectral Imaging

We would encourage you to contact us at info@cytoviva.com to learn how this technology can advance your research efforts.