PLASMONIC NANOPROBES

SERS-ACTIVE NANOPARTICLES FOR CELLULAR IMAGING

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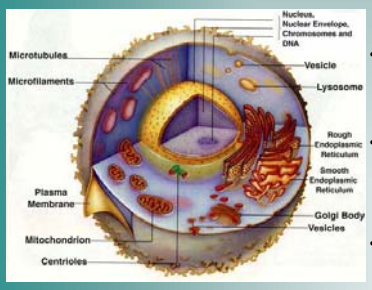
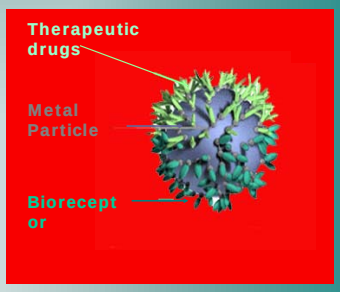
Nanoparticles and Plasmonics are increasingly finding wide applications in many areas related to environmental, medical diagnostics and homeland defense due to their unique electromagnetic, physical and chemical properties. Practical applications would require nanoparticles to be conjugated to biomolecules. Therefore a universal approach for conjugation of silver colloidal nanoparticles to biomolecules has been developed in our group. Surface functionalized silver colloids were labeled with a Raman-active dye and bio-receptor molecule and used as labels for cellular imaging.

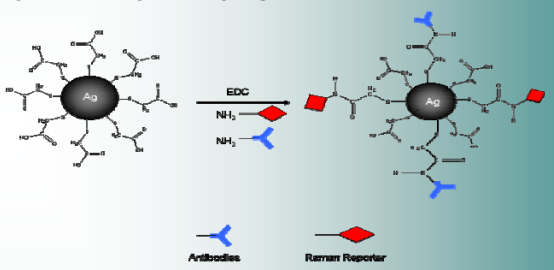


- **Plasmonics refers to the research area of enhanced electromagnetic properties of metallic nanostructures (plasmons are the quanta associated with collective motion of electrons).**
- **Excitation of surface plasmons leads to enormous electromagnetic enhancement [surface-enhanced Raman scattering (SERS) and surface-enhanced fluorescence (SEF)] for ultrasensitive detection.**
- **Advantages of SERS-based labels**
  - **Narrow spectral bandwidth**
  - **Resistance to photobleaching and quenching**
  - **Long-wavelength excitation of multiple labels**
- **Imaging the distribution and changes in the distribution of the molecules that make up the cell is an important way to learn about cellular processes that underly the molecular make-up and distribution.**
- **Monitor drugs and pathogens in living cells**
  - **For example, the cellular uptake, intracellular distribution, binding characteristics, intracellular pharmacokinetics, and cellular resistance of a drug generally determine the efficacy of the drug.**

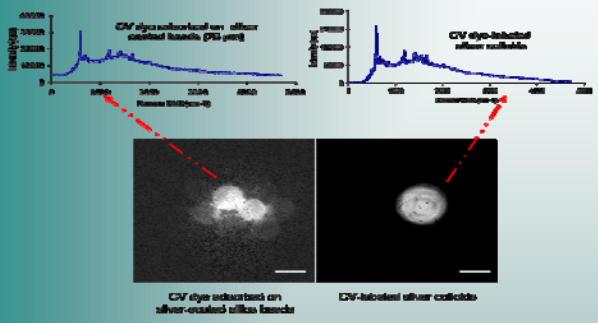


RECEPTOR-TARGETED SERS-ACTIVE NANOPARTICLES

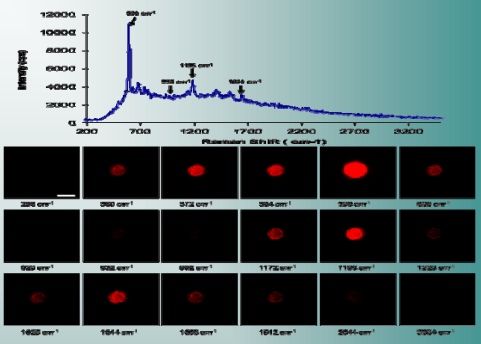
A schematic diagram depicting the functionalization scheme of colloidal nanoparticles with mercaptoacetic acid for covalent attachment of Raman labels and receptor specific biomolecules such as biotin, antibodies and DNA to recognize specific cellular enzymes and receptor.



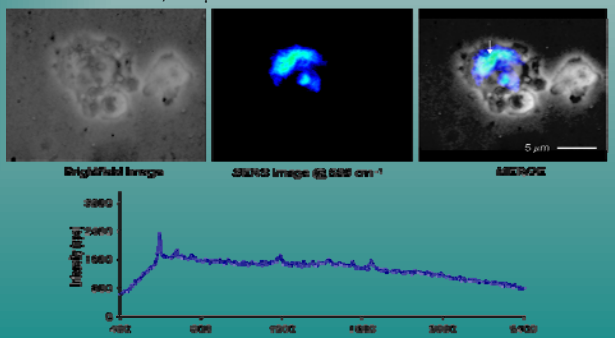
HYPERSPECTRAL SURFACE –ENHANCED RAMAN IMAGING (HSERI)



SERS images and spectrum of cresyl violet dye adsorbed onto 75 μm silver coated-silica beads (left) and CV-labeled silver colloidal particles (right). The images were acquired with the AOTF device set at a SERS intensity signal of 596 cm-1 using a 632.8 nm HeNe laser for excitation. Scale bar, 75 μm.



SERS spectrum and images of cresyl violet-labeled silver colloidal particles collected at various surface-enhanced Raman shifts. The images were acquired by scanning the AOTF over the entire spectrum using a 632.8 nm HeNe laser for excitation. Scale bar, 75 μm.



SERS images and spectra of CHO cells incubated with cresyl violet-labeled silver colloidal particles. The bright field image (Left) , the total SERS image (Middle) and the merged image (Right) of a fixed CHO cell are shown. The arrow indicates region within the cell where clusters of silver nanostructures are located. The total SERS spectra obtained from the cell is shown below. The SERS image was acquired at a SERS intensity signal of 596 cm^{-1} using a 632.8nm HeNe laser for excitation. Scale bar, 5 μm

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