Chapter - 11

NANOBIOLOGY

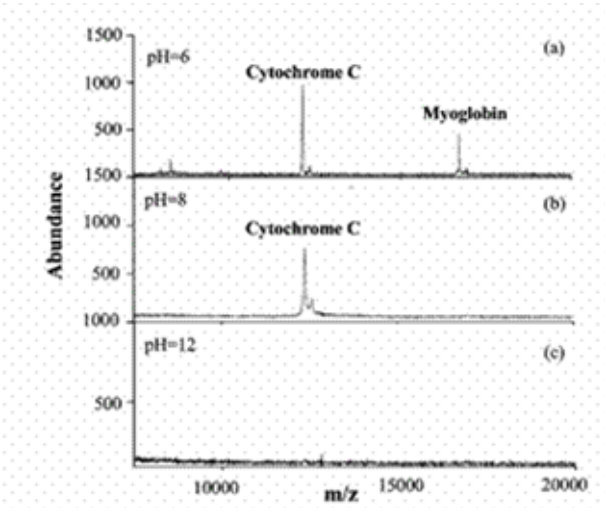


Figure 1 MALDI-TOF mass spectra obtained from a mixture of cytochrome c and myoglobin at (a) pH 6, (b) pH 8, and (c) pH 12**.** (From the article, Teng, C. – H.; Ho, K. – C.; Lin, Y. – S.; Chen, Y. – C. *Anal. Chem.* **2004**, *76*, 4337-4342.)

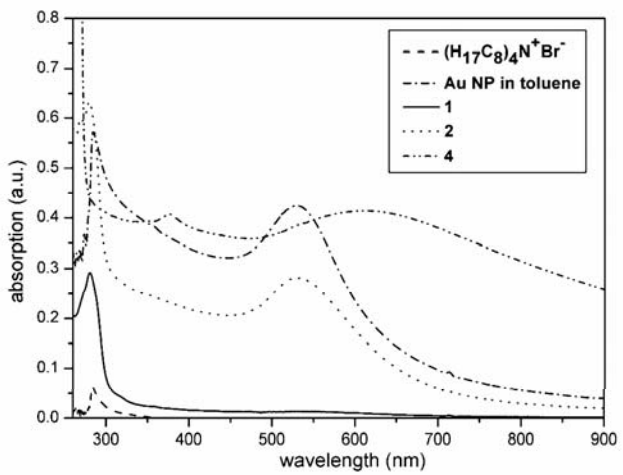


Figure 2 UV-visible spectrum of (1)vancomycin, (2) Au@vancomycin and (4) Au@cysteine (From the article, Gu, H.; Ho, P. L.; Tong, E.; Wang, L.; Xu, B. *Nano Lett*. **2003**, *3*, 1261-1263.)

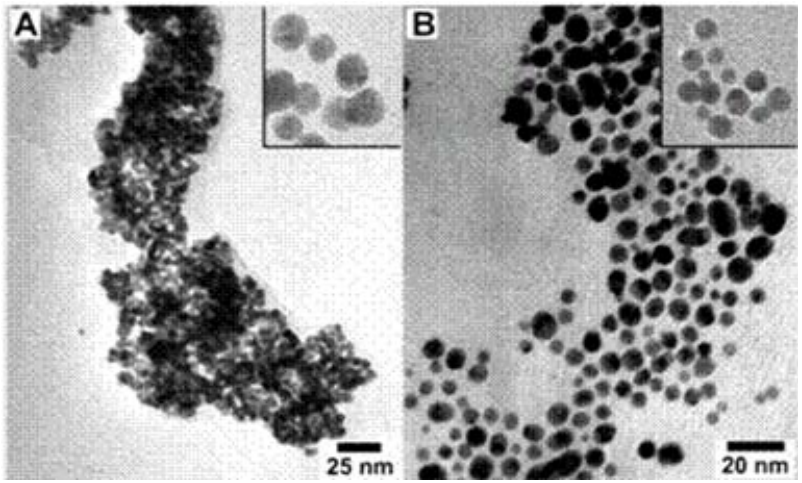


Figure 3. TEM image of cysteine (A) and vancomycin (B) capped gold nanoparticles, in the aggregated state after cryodrying at concentrations of 6.7 and 50 μg/mL. (From the article, Gu, H.; Ho, P. L.; Tong, E.; Wang, L.; Xu, B. *Nano Lett*. **2003**, *3*, 1261-1263.)

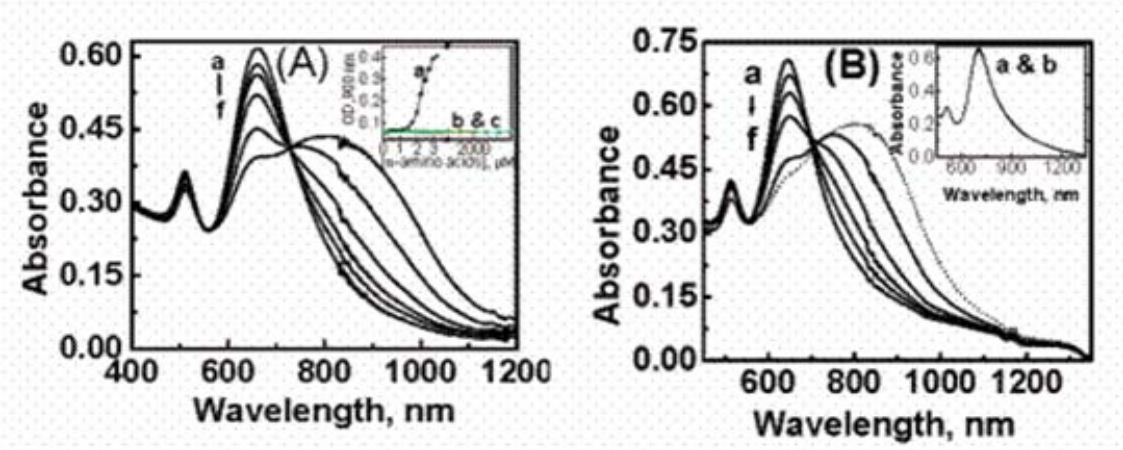
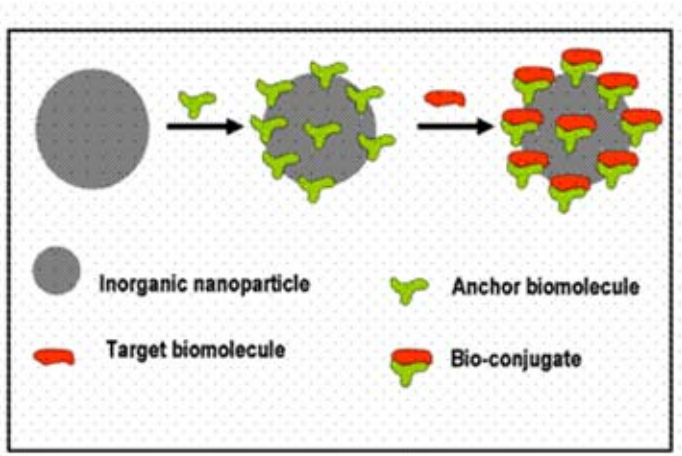


Figure 4. (A, B) Absorption spectral changes of Au nanorods (0.12 nM) in acetonitrile / water (4:1) on addition of (A) cysteine at (a) 0 (b) 1.75 (c) 2.0 (d) 2.25 (e) 2.5 and (f) 3 μM or (B) glutathione at (a) 0, (b) 7, (c) 9, (d) 11, (e) 13, and (f) 14 μM. Figure 1.3.A (inset): changes in optical density at different concentrations of (a) cysteine, (b) tyrosine, and (c) leucine. Figure 1.3.B (inset): effect of addition of 1-hexylmercaptan at (a) 0 and (b) 10 μM. (From the article, Sudeep, P. K.; Joseph, S. T. S.; Thomas, K. G. *J. Am. Chem. Soc.* **2005**, *127*, 6516-6517.)



Scheme 1. This scheme represents hybridization of conjugate biomolecules on inorganic nanoparticle surfaces.

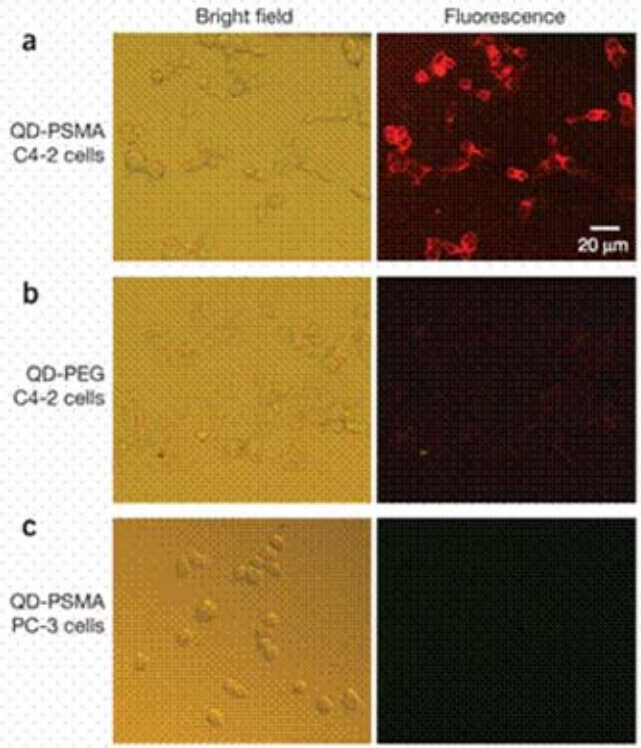
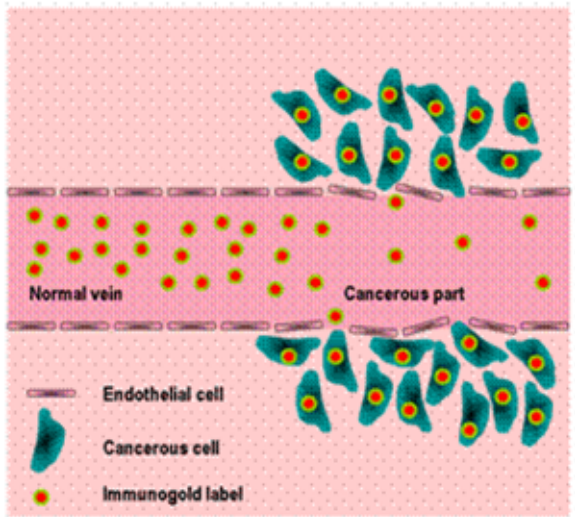


Figure 5. Interaction of CdSe@ZnS@PEG (QD-PEG) quantum dots with cancerous cells. C4-2 is prostrate cancer cells; PC-3 is non cancerous cells. QD-PSMA is functionalized with antibody of prostrate selective membrane antigen (PSMA-Ab). The negative staining of (b) and (c) can be explained by antigen-antibody interaction. (From the article, Gao, X.; Cui, Y.; Levenson, R. M.; Chung, L. W. K.; Nie, S. *Nature Biotechnology* **2004**, *22*, 969-976.)



Scheme 2. The scheme represents of mechanism of site specific immunogold labeling.

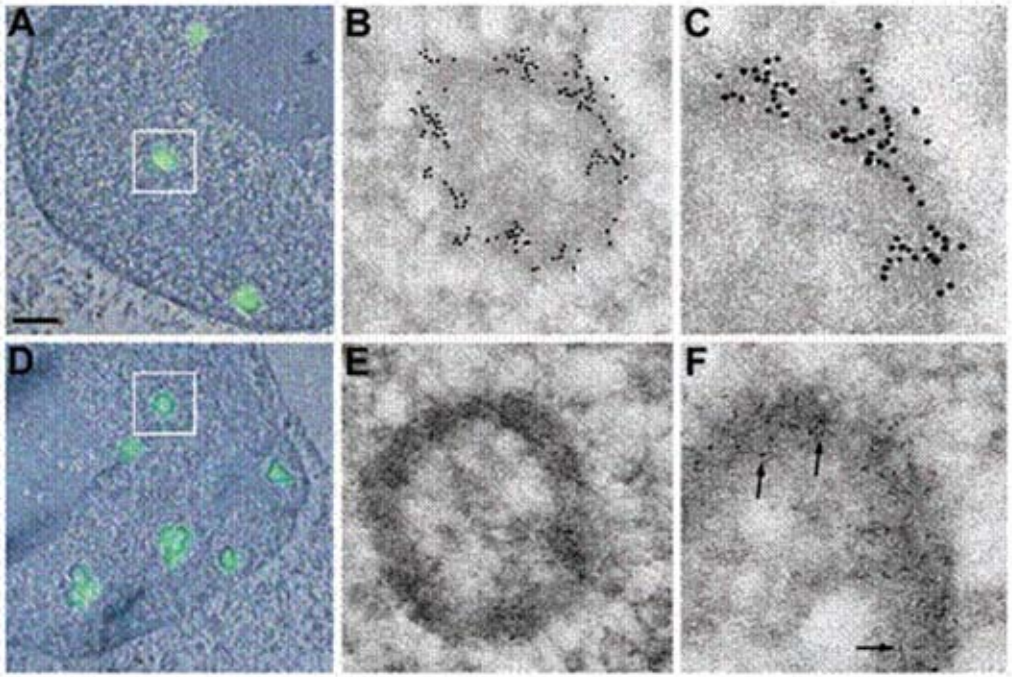


Figure 6. Target selective fluorescent and TEM imaging of PML bodies on cell nucleus using 10-nm gold and 10-15 nm CdSe nanocrystals. A and D are fluorescence image of HEp-2 PML I cells labeled with gold and CdSe particles, respectively. On gold-labeled sections, a Cy3 dye labeled secondary antibody was used, after incubation with gold, for generation of the fluorescence signal. B and E are the TEM image of the marked areas given in Figures A and D, respectively. C and F are the enlarged view of B and E, respectively. The dimension of the bar corresponds to 1000 nm, 100 nm and 50 nm for the set of figures (A, D), (B, E) and (C, F), respectively. Sections were stained with uranyl acetate. The arrows in F marks CdSe nanocrystals. (From the article, Nisman, R.; Dellaire, G.; Ren, Y.; Li, R.; Bazett–Jones, D. P.; *J. Histochem. Cytochem.* **2004**, *52*, 13-18.)

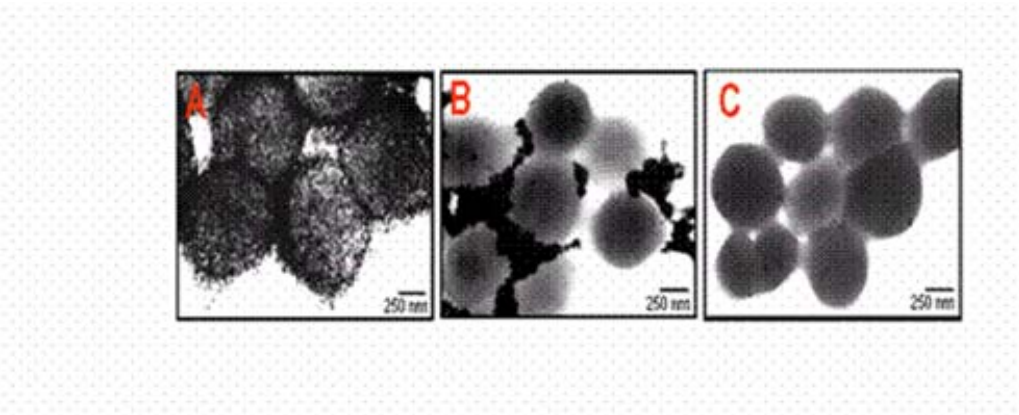


Figure 7. TEM images of *Staphylococcus saprophyticus* obtained after incubating these bacteria with (A) Au-IgG nanoparticles, (B) unmodified gold nanoparticles, and (C) Au-BSA nanoparticles. (From the article, Ho, K. – C.; Tsai, P. – J.; Lin, Y. – S.; Chen, Y. – C. *Anal. Chem.* **2004**, *76*, 7162-7168.)

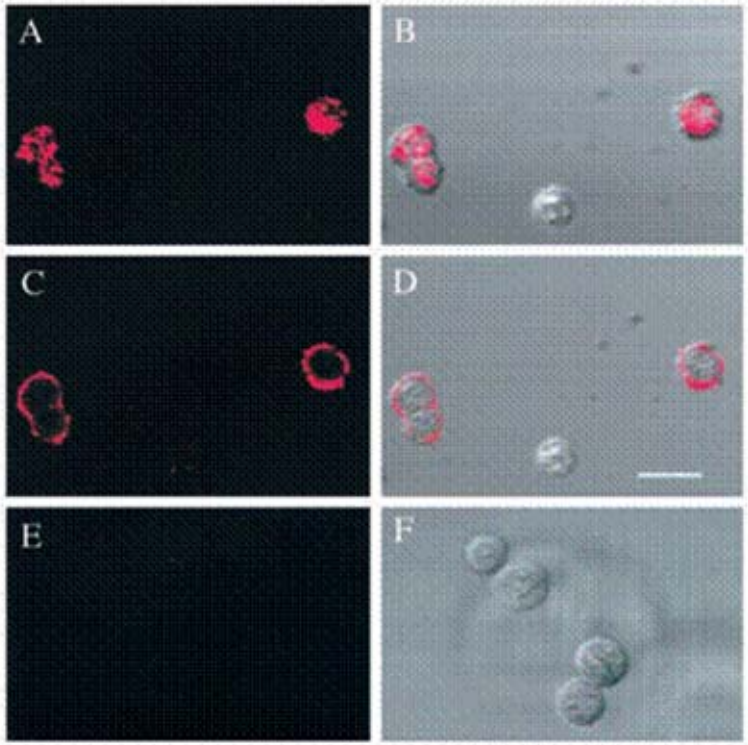


Figure 8. High resolution optical images of SiHa cells labeled with anti-EGFR/gold conjugates. Nonspecific labeling using gold conjugates with BSA is shown in E and F. Laser scanning confocal reflectance (A, C and E) and combined confocal reflectance/transmittance (B, D and F) images were obtained with 40 X objective. Scattering from gold conjugates is false-colored in red. In A and B, the focal plane is at the top of the cells. The middle cross-section of the cells is in focus in images, C and D. The confocal reflectance and transmittance images were obtained independently and then overlaid. Reflectance images were obtained with 647 nm laser excitation. The scale bar is 20 μm (A-F). (From the article, Sokolov, K.; Follen, M.; Aaron, J.; Pavlova, I.; Malpica, A.; Lotan, R.; Richards-Kortum, R. *Cancer Research* **2003**, *63*, 1999-2004.)

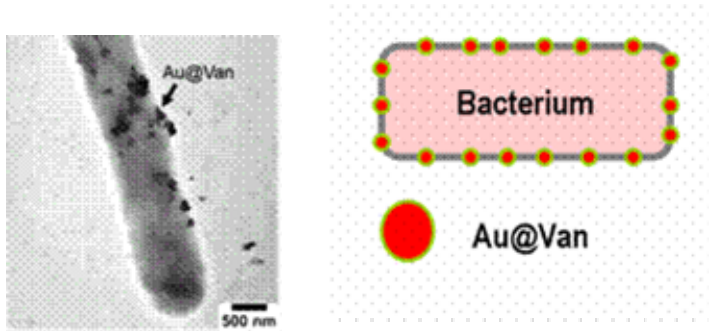
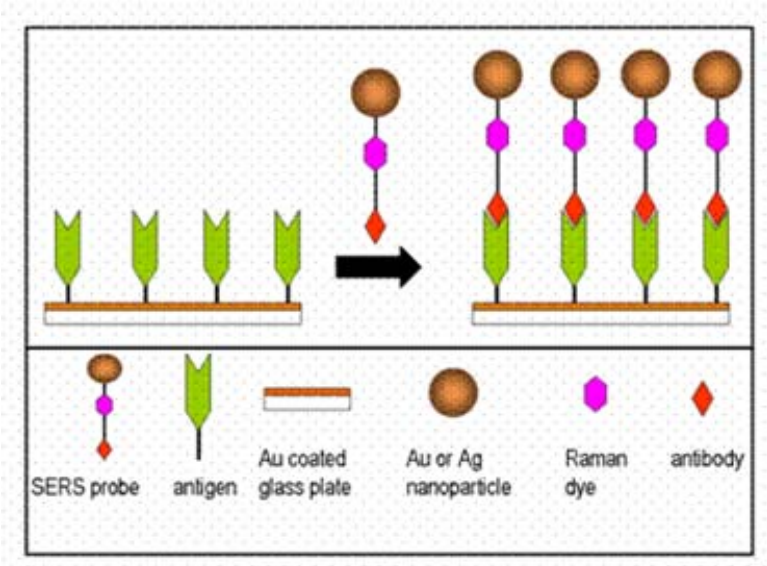


Figure 9. TEM image of *E. coli* after being treated by Au@van at minimum inhibition concentration (50μg/mL). The scheme represents cross-section of *E-coli* after Au@van immobilization. The scheme is showing Au@van is selectively sitting on the cell membrane of the bacterium. (From the article, Gu, H.; Ho, P. L.; Tong, E.; Wang, L.; Xu, B. *Nano Lett*. **2003**, *3*, 1261-1263.)



Scheme 3. This scheme represents immunoassay based on target selective surface enhanced Raman scattering (SERS) probe.

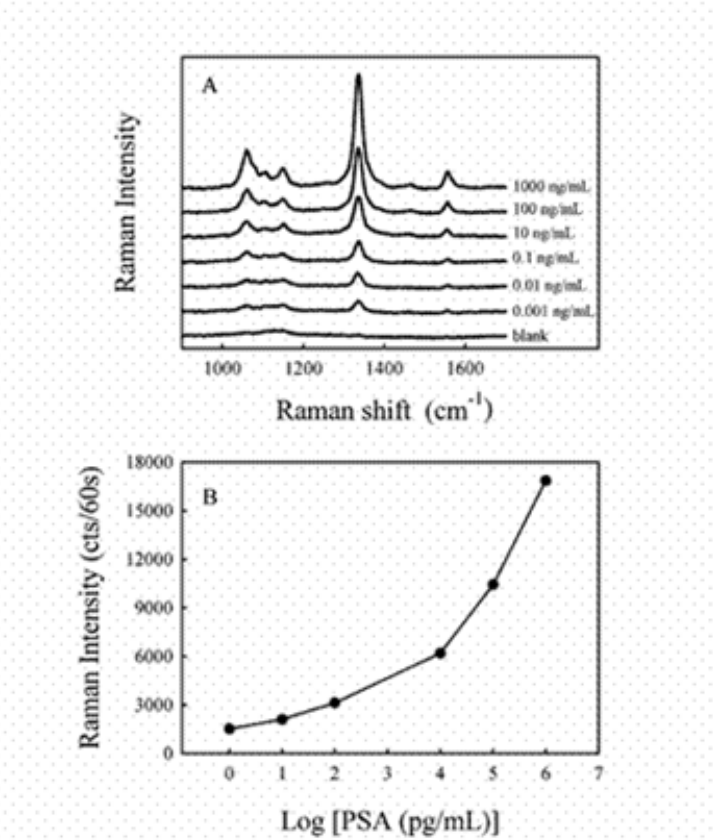
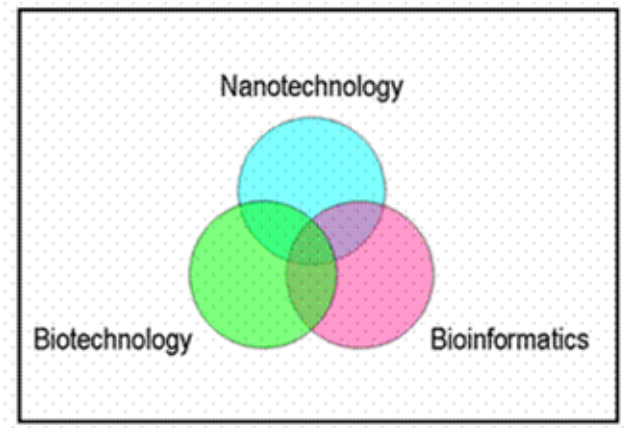


Figure 10. Demonstration of a SERS-based free PSA immunoassay. (A) SERS spectra, offset for clarity, acquired at various PSA concentrations. (B) Dose-response curve for free PSA in human serum. (From the article, Grubisha, D. S.; Lipert, R. J.; Park, H. – Y.; Driskell, J.; Porter, M. D. *Anal. Chem*. **2003**, *75*, 5936-5943**.)**



Scheme 4. Schematic representation of the evolution of nanobiotechnology