

**Biochemistry Cume**  
March 4, 2016  
Chemical Biology/Bioimaging  
Prof. Larry Miller

The review by Vasudevanpillai was a broad description of nanomaterials and their biomedical applications with a particular focus on methods to chemically functionalize the materials and conjugate them to biomolecules. This cume will focus on nanomaterial chemistry and *bio-imaging* applications of **three** types of materials detailed in the review:

- 1) silica nanoparticles;
- 2) gold nanoparticles;
- 3) semiconductor quantum dots.

For **each** of the materials listed above, please provide the following information.

- 1) The **primary** chemistries that are used to make the particle bio-compatible. Specifically, what is the nature of the particle surface? What chemical functionalities must be appended to the surface so that the particle is water-soluble and ready for bio-conjugation (i.e., what is the method of surface passivation)?
- 2) Describe 3 strategies available for conjugating each particle to bio-molecules.
- 3) Describe the physical basis for signals (e.g., luminescence, raman enhancement) that are characteristic of each class of particles, and describe the modes of bio-imaging that can detect these signals to generate image contrast.
- 4) Briefly describe 3 strategies for targeting nanoparticles to tumors *in vivo*.