

## **Lecture 4: Designing "Theragnostic" Systems**

- I. Bridging the gap between diagnostics and therapeutics
  - A. How conventional medicine is practiced in terms of diagnostics and therapeutics
  - B. The consequences of separating diagnostics and therapeutics
  - C. A new approach – "theragnostics" (or "theranostics")
  
- II. Examples of current theragnostic systems
  - A. Example: Rituxan ("Rituximab")(an example of not using diagnostics to guide the therapy)
  - B. Example 1: Herceptin ("trastuzumab")
  - C. Example 2: Iressa ("Gefitinib")
  
- III. How theragnostics relates to Molecular Imaging
  - A. Conventional imaging is not very specific
  - B. Types of In-vivo Imaging
    1. X-rays, CAT (Computed Axial Tomography) scans,
    2. MRI (magnetic Resonance Imaging)
    3. PET (Positron Emission Tomography) scans
  - C. "Molecular Imaging"
  
- IV. Engineering nanomedical systems for simultaneous molecular imaging
  - A. Using nanomedical cores for MRI contrast agents
  - B. Difficulties in using PET probes for nanomedical devices
  - C. Using cell-specific probes for molecular imaging of nanomedical devices
  - D. Breaking the "diffraction limit" – nano-level imaging
  
- V. Theragnostic nanomedical devices
  - A. Using nanomedical devices to guide separate therapeutic device
  - B. When might we want to combine diagnostics and therapeutics?

### **References:**

BJJ Abdullah, Molecular imaging: spawning a new melting-pot for biomedical imaging  
Biomed Imaging Interv J 2006; 2(4):e28 pages 1-7.

Chul Ahn, Pharmacogenomics in Drug Discovery and Development, Genomics & Informatics  
Vol. 5(2) 41-45, 2007

Eric Betzig, George H. Patterson, Rachid Sougrat, O. Wolf Lindwasser, Scott Olenych,  
Juan S. Bonifacino, Michael W. Davidson, Jennifer Lippincott-Schwartz, Harald F. Hess  
Imaging Intracellular Fluorescent Proteins at Nanometer Resolution  
SCIENCE VOL 313: 1642-1645, 2006