

**Department of Chemical Engineering Seminar**

**Friday, May 3, 2013**

**3:30PM – E6 2024**

**Multifunctional Polymers and Nanoparticles for  
Theranostics**

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Multifunctional polymers and nanoparticles have been investigated extensively for drug delivery (therapy), biomedical imaging (diagnosis), or for simultaneous therapy and diagnostics (coined as theranostics), because of their ability to deliver a variety of therapeutic and imaging agents and conjugate with targeting moieties. Nanoparticles, in particular, are able to carry large cargo and accumulate in tumor tissue by the enhanced permeation and retention effect (passive targeting) when they are engineered with appropriate size and surface properties. They can also be modified to achieve active targeting to tumor and specific cell types for targeted drug delivery and disease detection. We have devised a lipid-based near infrared (NIR) imaging probe system that has overcome the common problems of toxicity and instability of currently available fluorescent quantum dots. The system is biocompatible *in vivo* and useful for imaging of deep tissue in whole live animal. The same nanoparticle system can also deliver anticancer drugs. With surface-conjugated peptide, we were able to image tumor angiogenesis *in vivo*. We have designed a thermal responsive polymer-lipid hybrid nanoparticle magnetic resonance imaging (MRI) contrast agent for non-invasive detection of temperature in body. We have also developed a multifunctional terpolymeric system for MRI, optical imaging and drug delivery. These systems have a great potential for preclinical and clinical use. This presentation will first introduce the concept of “theranostics”, review imaging modalities for clinic and preclinical use and types of nanoparticles used for imaging and drug delivery, and then discuss the application of multifunctional polymers and nanoparticles in cancer theranostics using our systems as examples.

## Biography

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Dr. Wu is a Professor and Director of Advanced Pharmaceutics and Drug Delivery Laboratory, at the Leslie Dan Faculty of Pharmacy, University of Toronto. She received Master and Bachelor's training in Polymer Science and Engineering in China and her Ph.D. degree in Chemical Engineering from McMaster University, Canada. Having completed postdoctoral fellowship for over two years at the University of Toronto, she joined the faculty in 1994 as Assistant Professor, and later progressed to Full Professor with tenure. Dr. Wu's research is highly interdisciplinary and translational. Her research interests include novel nanomedicine for targeted and enhanced chemotherapy of multidrug resistant and metastatic cancer, multifunctional polymer and nanoparticle systems for combined multimodal imaging and drug delivery (nanotheranostics), nanotechnology and "smart" polymer-enabled closed-loop insulin delivery, mechanistic studies, mathematical modeling and computer-aided design of controlled release drug delivery systems. Dr. Wu and coworkers have published over 300 papers, book chapters, proceedings and abstracts, and held 16 issued and pending patents in 40 countries. Dr. Wu has been a referee of numerous journals and served on editorial boards of several journals including journal *Pharmaceutical Nanotechnology* (UK) and journal *Drug Delivery and Translational Research* (an official journal of the Controlled Release Society). She has served on various scientific and organizing committees and delivered numerous invited presentations in North America, Europe, Asia, Mid-East, and Latin America.