



Co-sponsored by Mechanical Engineering

PROF. WEI CHEN

Nano-Bio Physics, Department of Physics
University of Texas at Arlington, Texas

Nanoparticle Based Photodynamic Therapy For Cancer Treatment

Cancer is a class of diseases in which a group of cells display *uncontrolled growth*. Every year, about 562,340 Americans are expected to die of cancer, more than 1,500 people a day. Cancer is the second most common cause of death in the US, exceeded only by heart disease. In the US, cancer accounts for nearly 1 of every 4 deaths. Early detection and effective treatment are the best hope for cancer patients. Photodynamic therapy (PDT) is a promising recipe for cancer treatment. However, the difficulty of light penetration into deep tissue has hitherto prevented the application of photodynamic therapy for deep cancer treatment. The three components that are required for PDT are oxygen, photosensitizers, and light. It is commonly accepted that *singlet oxygen* is the predominant cytotoxic agent produced during PDT. Therefore, PDT efficiency is largely determined by the yield of singlet oxygen, which is a product of photosensitizer structure, light absorption characteristics (intensity and wavelength), and oxygen concentration. Light must be delivered to the photosensitizers to activate them. Light in the near infrared range of 700-900 nm, provides best tissue penetration. All current porphyrin-derived PDT compounds, such as Photofrin, have a strong absorption band near 400 nm called the Soret band. The Soret band absorption is more than 10 times stronger in intensity than the absorption at 630 nm. Unfortunately, attempting to activate porphyrins through absorption at the Soret band is not practical because blue light has minimal penetration into tissue; thus, direct photodynamic therapy is not efficient for deep cancer treatment.

To solve the problem of light penetration and to enhance the PDT treatment for deep cancers, I have proposed a new PDT system in which the light is provided by afterglow nanoparticles with attached photosensitizers. When the nanoparticle-photosensitizer conjugates are targeted to tumor and stimulated by X-ray during radiotherapy, the particles will generate light to activate the photosensitizers for photodynamic therapy. Therefore, the radiation and photodynamic therapies are combined and occur simultaneously, and the tumor destruction will be more efficient. More importantly, it can be used for deep tumor treatment as X-ray can penetrate deep into the tissue such as Breast and prostate cancers. This novel modality is called *nanoparticle self-lighting photodynamic therapy (NSLPDT)*. In this presentation, I will report the progress of the research in my group on the design, synthesis and evaluation of nanoparticle conjugates for photodynamic therapy.

Host:
Prof. Jinsong Huang
Department of
Mech. Engineering

Please Post

Friday, October 29, 2010
N129 SEC, 2:30 p.m.