The Interface Between Nanomaterials and Medicine

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Photodynamic therapy (PDT) is a treatment that uses photosensitizers in conjunction with light to destroy cancerous cells *via* cytotoxic singlet oxygen. Since its initial clinical use thirty years ago, efforts to improve PDT have focused on two complications. 1) Short wavelength light (<550 nm) does not penetrate through tissue well. 2) Sunlight can activate photosensitizers located in healthy tissue. For cancer patients undergoing PDT, irritation and blistering of skin that is exposed sunlight is a painful side effect.

We are developing switchable photosensitizers by coupling porphyrin photosensitizers to gold nanoparticles to cause their deactivation. Oligonucleotide hybridization events can provide a means of reactivating the photosensitizers by attachment of the nanoparticle and the photosensitizer at either end of an oligonucleotide strand. This switching approach can be used to increase the specificity of PDT and to prevent damage to healthy tissue.

The development of these switchable PDT agents will be discussed, including biocompatible nanoparticle preparation, porphyrin synthesis, and oligonucleotide conjugation. Gold nanoparticles have been synthesized using biocompatible ligands such as lecithin which is extracted from soy. Lecithin is a naturally occurring phospholipid which we anticipate will render these gold nanoparticles safe for *in-vivo* applications. The synthesis of long wavelength (> 600 nm) porphyrins, for attachment to oligonucleotide strands will also be reported.