Title: Viral photosensitivity: cellular photoregulation through synthetic biology approaches

Key words: Photochemistry, photoregulation, synthetic biology, unnatural amino acids, photolabile, cage, superfolding proteins.

Many parts and processes of organisms, including those which may be defective or deleterious, are determined by gene sequences, and genetic therapies are the utilization of emergent technologies to prevent or ameliorate the expression of these genes. With such capabilities, scientists can inhibit or induce control over diseases both between and within organisms. These genetic engineering approaches have been increasingly supplemented with advances in photochemistry and synthetic biology, among other disciplines. From the first "caging" as a chemical manipulation in 1970 to the study of natural mammalian genetic regulatory systems, the use of photosensitive inactivating groups has developed over three decades into many sophisticated mechanisms of genetic control. As an example, I am currently conducting research for a thesis project regarding the site-specific modification of oligonucleotides for use with photocage groups. The project will increase the efficiency with which cage molecules can potentially direct antisense techniques and determine to understand precisely the steric, chemical, and other effects of one or multiple latent residues within common proteins. These "unnatural amino acid" techniques are recent developments, and have yet to be applied in mammalian cells or for therapeutic purposes.

My hypothesis is that synthetic genomic additions can be utilized both to generate cells en masse and to trigger clear or dire responses. For example, members of the cysteine-aspartic acid protease family, such as Caspase 3, may be moved experimentally by up-regulating each protein independently in a series of assays with the cell line in culture. Following affirmation of the toxicity or efficacy of large influxes of the selected protein, the experimentally by up-regulated in culture through the modified amino acid pathway with at least three species of photochemistry modulates cells on a pre-transcription level; it would be a more direct, fundamental approach to genetic and cellular control. The technology could also be used to produce modern modifications of photosensitive molecules for mammalian cells: the genetic coding for a photocaging mechanism with each peptide would be inserted into the genome of organisms. These genetic engineering approaches have been increasingly supplemented with work-arounds further explicit labels for IM and BI...