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Nanomedicine

The goal of Nanomedicine is to develop new diagnostic and therapeutic agents derived from fundamental discoveries in nanotechnology that can be applied safely and efficaciously in the treatment of human diseases. We have developed a number of platforms that meet these goals that have now progressed to clinical trials. In particular, emulsion based nanoparticle comprising perfluorocarbon cores and lipid-surfactant shells can be functionalized with imaging agents, drugs, genes, and targeting moieties to bind to specific molecular epitopes for both sensitive image-based detection and drug delivery at high local concentrations. Novel methods for the use of MRI, ultrasound, CT, optical and nuclear diagnostics have been developed. Drug delivery through unique mechanistic pathways involving fusional complexation of soft nanoparticles with cell membranes transports drugs (small molecules, cytolytic peptides, oligonucleotides, etc.) to cytoplasm for immediate effect. Novel pharmacokinetic approaches allow quantification of local drug delivery based on noninvasive imaging readouts. These and other innovations promise to alter the traditional paradigm for delivery and monitoring of therapeutic agents by taking advantage of targeted delivery at low serum concentrations that should reduce side effects while improving selective deposition of agents at greater concentrations than can be achieved by traditional diffusional mechanisms.