Fairy tale, fantasy and science fiction stories are replete with magical (or high tech) healings in which a wand or an electronic scanner is passed over an injury or illness, and the wound or infirmity is quickly and painlessly healed. No knife, no blood, and no pain—what a wonderful world it would be. Unfortunately, modern medicine has not yet caught up with our dreams of painless and non-invasive healing. However, we are making progress towards such a goal with ultrasonic drug and gene delivery, a non-invasive and painless technology that can direct therapeutic energy and release healing agents to target sites within the body.

Ultrasound (US) technology in medicine has developed rapidly over the past four decades. Although US was first used therapeutically [1], its use in diagnostic imaging commenced shortly thereafter [2] and quickly surpassed its therapeutic use in the clinic. While the concepts and applications of therapeutic use were slowly incubating, the need for non-invasive diagnostic imaging engendered the rapid development of ultrasonic technology. Now this mature technology is spreading to other medical applications, including a return to its roots of medical therapy.

In this issue, we present the current applications and future prospects of ultrasound in various aspects of drug and gene delivery. There are many advantages to ultrasound that make it ideal for the delivery of therapeutics and the stimulation of tissues—perhaps the most important of which is that US is a mechanical and yet non-invasive means of delivery that can be applied to a very wide range of therapeutics and target sites.

Another great impetus to the advancement of ultrasonic drug and gene delivery was the advent of engineered gas bubbles that were originally developed as contrast agents for imaging applications. Excitation of these bubbles by insonation leads to fluid convection, high fluid shear stresses, shock waves, free radicals, and high temperatures, all of which can produce significant biological effects, both beneficial and harmful to cells. The beneficial effects, with respect to drug and gene delivery, include the loosening of cell-to-cell junctions, the permeabilization (and even pora-

doi:10.1016/j.addr.2008.03.001

William G. Pitt
(Theme Editor)

Chemical Engineering Department, 350 Clyde Building
Brigham Young University, Provo, Utah, 84602
Corresponding author. E-mail address: pitt@byu.edu

Ghaleb A. Husseini
(Theme Editor)

Chemical Engineering Department, P.O. Box 26666
American University of Sharjah, Sharjah
United Arab Emirates E-mail address:
ghusseini@aus.edu

References
