Drug delivery systems, like so many other medical technologies, have undergone a renaissance in the last few decades. In the earliest history of such systems, doctors generally prepared liquid medications to be taken orally. Inhalable and injectable medications soon followed. Patches to slowly diffuse medications through the skin have been developed more recently.

Even more recent advancements include nanoparticles capable of releasing therapeutic agents targeted to specific locations. Similarly, so-called nano-bubbles are capable of targeting tumors and waiting to release their molecular payload until energy from ultrasound breaks them apart.

Although many of the early methods are still being used today, we are going to concentrate on some of the more recent developments.

Inhalable medicines are a classic delivery system that has very predictable effects. It has a rapid activation time, since it is absorbed into the lungs and almost directly into the bloodstream. It also easy to use at home, has a very easily controlled dosage, and is easy to produce.

Transdermal patches are also very popular today, currently delivering over 20 types of medicines. Patches offer easy application, and a controlled and timed release, with only a small chance of irritation or allergic reaction.

Newer technologies include a variety of nanoparticulate delivery systems. In general, they allow for trans-cellular delivery, and reliable molecular targeting. Because of their size, they are also able to pass through the blood-brain barrier. This combination makes nanoparticulate delivery systems one of the most effective to date. They have many potential applications, as they are truly a generic delivery system.

One such delivery system involves the use of so-called nanobubbles. These bubbles encapsulate therapeutic molecules, and attach to targeted tumor surfaces. After the bubbles have accumulated on the tumor, ultrasound scanning is initiated. The bubbles not only help to render a clearer ultrasound image, but they also become energized and burst, releasing the medicines.

New dissolvable strips are also making it easy to treat unwilling infants and those for whom other methods aren’t ideal. These pH-responsive polymer coated strips can carry vaccines and other drugs to different parts of the digestive tract.

In general, there is a need for new and unique delivery systems to address many of the problems facing the pharmaceutical problems both today and in the future. Many of these will be solved with miniaturization and nano-scale technologies, but others will require creativity and innovation to adapt older technologies to new problems.

- Ultrasound-Enhanced Tumor Targeting of Polymeric Micellar Drug Carriers
- Novel human-derived cell-penetrating peptides for specific subcellular delivery of therapeutic biomolecules