Exciting developments are occurring in the field of alternative drug delivery—a phrase that describes the reformulation of drugs to enable lower doses, more convenient delivery routes, and supplemental therapeutic indications. This report presents an overview of these developments, describes the options that new formulation technologies are creating, and explores the medical and commercial perspectives.

Discussed in this report:

- The enabling role of medical devices in drug delivery technology
- Drug delivery applications of nanotechnology
- How advanced drug delivery can overcome biological barriers
- Alternative delivery modalities for biotechnology-derived drugs
- Nucleic acid delivery technologies
- Resurgence of transdermal delivery technology
- Role of alternative delivery in drug lifecycle management
- Corporate showcase of 29 drug delivery companies including NanoViricides, Starpharma Holdings, CyDex Pharmaceuticals, Nektar Therapeutics, SurModics, MannKind, NanoBio, and Vytis
The pharmaceutical industry is paying attention to aspects of innovation and business development that it has always employed occasionally but not systematically. These involve finding new uses for known active ingredients, by repurposing them to entirely new therapeutic fields or by leveraging modern formulation technology to significantly improve their properties.

We begin by describing the main routes of drug delivery (oral, injection/infusion, and transdermal), their pros and cons, and the environment in which they are deployed. We also explain that “alternative” drug delivery is not so much about fundamentally different “roads into the unknown” that have not been taken before, but about new dimensions of the known routes. In other words, what we call alternative drug delivery consists of clever technical advancements along what ultimately are the known routes.

The enabling role of medical devices in drug delivery technology is addressed next. Drug-eluting stents and other implantable drug delivery devices are presented, as well as externally applied devices. Next, drug delivery applications of nanotechnology are introduced. When combined with appropriate targeting moieties, drug-coated nanoparticles, drug-encapsulating liposomes and nanotubes, and tree-like dendrimers enable organ and tissue targeting.

After a discussion of ways in which drug delivery can overcome anatomical and functional barriers, the report turns to alternative delivery modalities for peptides, proteins, and antibodies. These biotechnology-derived drugs were formerly administered by injection alone, but today, solutions for inhaled, transdermal, and even oral delivery are available or under investigation for most established products.

Next, we consider nucleic acid delivery technologies, which are not actually “alternative” but are initially enabling for their novel cargoes, since unprotected or untargeted delivery of gene therapies or RNAi is inconceivable. We then move on to developments in transdermal delivery technology, which includes active systems where delivery is driven by microneedles or energy applied via ultrasound or lasers.

We then explore the role of alternative delivery in drug lifecycle management. Case studies demonstrate how cleverly applied technologies can reinvigorate drugs that have lost patent protection or have not fully exploited their potential. We also present unique technologies with broad applicability in alternative drug delivery. Regulatory pathways and timelines for obtaining patents for the new products are addressed. Selected drug delivery firms, their technological approaches, pipelines, and collaborations are profiled. We conclude with an outlook to what we call the “Preprogrammed Rise of Alternative Drug Delivery”—an unavoidable development driven by the fact that lifecycle management and recouping of value from existing resources will continue to rule the pharmaceutical industry’s business throughout the 2010s.
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