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Special Section on Drug Delivery Technologies—Commentary

Engineering Next-Generation Medicines: It's All About Delivery

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It is not at all surprising to say that "drugs" do not deliver themselves, and always need a "vehicle" to do so. The innovation in the delivery vehicles relates to the complexity in the drug discovery process, where drugs that are believed to be highly potent are incidentally associated with poor physicochemical attributes. The poor physicochemical attributes of drugs, combined with the biologic barriers, the immune system, and the disease in question itself pose formidable challenges to drug delivery scientists. The innovative delivery technologies are also equally important in the repurposing of old drugs for new indications, and there is a huge demand in this space as this involves the use drugs whose pharmacology is well understood.

There are some groundbreaking discoveries that led to several unconventional drug products, such as polymer microparticles (e.g., Lupron Depot; AbbVie Inc., North Chicago, IL; and Bydureon; AstraZeneca, Cambridge, UK), liposomes (e.g., Doxil; Janssen, Titusville, NJ; and AmBisome; Gilead Sciences, Inc., Foster City, CA), and polymer implants (e.g., Gliadel Wafer; Arbor Pharmaceuticals, LLC, Atlanta, GA), that facilitate better treatment regimens than conventional products such as tablets and capsules in intended areas. Similarly, better understanding of skin science has led to the development of transdermal patches (e.g., Butrans; Purdue Pharma L.P., Stamford, CT; and Estraderm; Novartis, Basel, Switzerland) that are extensively applied to drugs prone to first-pass effects when delivered perorally or applied to those conditions and molecules, where a constant rate (zero-order kinetics) of delivery is deemed necessary for relief. On the other hand, improvised application procedures such as intravitreal injections led to the discovery of next-generation ocular implants (e.g., Ozurdex; Allergan, Dublin, Ireland). The interest in drug delivery technologies is on the rise, aiming to realize the fullest potential of delivery strategies that not only are expected to achieve altered pharmacokinetics and drug disposition, but also to minimize non–target drug distribution and to explore novel mechanisms of action of the existing drugs by altering dose regimens and routes.

Some of the advances made in nonconventional delivery strategies are further improved, taking them to the next level (e.g., transdermal patches to microneedles) (~50 clinical trials), nanoparticles to target specific nanoparticles, or the nanoparticle products that are on the market for one indication tested for new indications (~50 clinical trials). There are often clinical and market advantages in improvising the implantable devices to smart devices such as drug-eluting technologies (~600 clinical trials), as well as in using existing products to treat other indications (e.g., liposomes) (~2200 clinical trials). The overall goal of these efforts seems to be maximizing the utility of next-generation delivery strategies to facilitate the delivery of difficult-to-deliver molecules or to treat the untreatable, while keeping the market's edge.

Therefore, this special issue is an effort to reflect on the past and peek into the future by bringing together a collection of articles covering a variety of topics regarding different delivery technologies and their application in treating various diseases. This issue comprises research and review articles from active researchers all around the world, and I sincerely thank each one of them who made this issue possible with their valuable contributions.

This indeed is a very exciting time in the field of advanced drug delivery that demands participation of researchers from complimentary disciplines to make this a multidisciplinary reality. I look forward to the continued success of the authors who contributed to this issue, as well as others, in the coming years.

In closing, I thank *The Journal of Pharmacology and Experimental Therapeutics* editor Dr. Kenneth D. Tew and his excellent team, who have helped me and the authors bring out this valuable special section on drug delivery technologies.

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