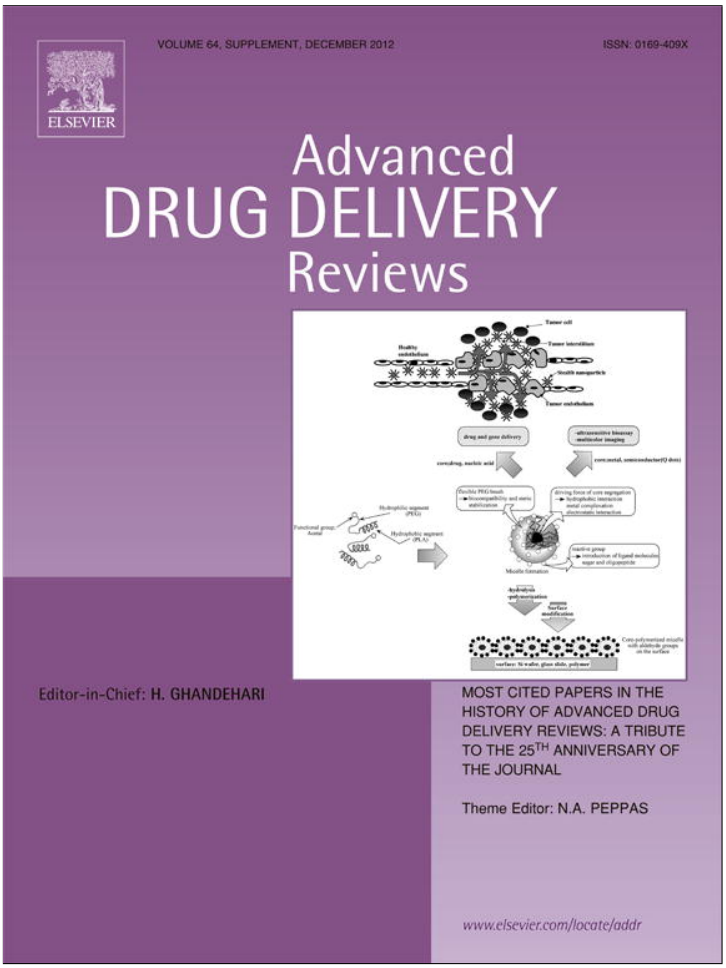

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Preface

An introduction to the most cited papers in the history of Advanced Drug Delivery Reviews (1987–2012)☆

This special anniversary issue of *Advanced Drug Delivery Reviews* (ADDR) celebrates 25 years since the publication of the first issue of the journal and includes the most cited articles in the history of ADDR. As I was going through these seminal reviews in the field, the subjects brought back memories, and even a tear, from the glorious early period of drug delivery and controlled release. It made me remember how important this journal is in the history and growth of the drug delivery field.

Since May 1987, when the first issue of the journal came out, ADDR has made significant contributions to the education of our practitioners in the field, especially with the exceptional theme volumes on biological and medical aspects of drug delivery. We all join in celebrating 25 years of exceptional work and we thank the editors, notably the initial Senior Editors George Poste, Eric Tomlinson (with Colin Pouton, Sadao Hirota, and Vince Lee as editors), and then the more recent Editors-in-Chief Vince Lee and Hamid Ghandehari for their strong leadership and high standards.

As I reviewed again the most cited articles in ADDR I came back to important marks in the history of drug delivery. Most of the papers presented in this issue have received more than 250 citations since the founding of the journal according to the Scopus® abstract and citation database (see Table 1). About three-quarters of the papers are post-2000. The impact in the field is really significant as these reviews have 30–90 citations per year. The most highly cited paper in ADDR is the classic work of Lipinski et al. of Pfizer, Inc. [1]. This review article was published in 1997 and addresses one of the simplest, yet most important, methods for the estimation of drug solubility and permeability, the so-called "rule of 5". The contribution has a very useful analysis of permeability of high and low solubility drugs with emphasis on the use of the "rule of 5" in analyzing barrier transporters. It has become a standard on design of new drug delivery systems as more than 2700 citations indicate.

The second most highly cited paper is by Hoffman of the University of Washington [2], who in 2002 published a most successful review on hydrogels in medical applications, a review that attracted almost 1100 citations in 10 years. This is an authoritative contribution that has been used by many scientists in the field. An equally exciting work is on the use of nanoparticles in cancer therapy. This review article written by Couvreur and associates of the University of Paris-Sud [3] is a masterful presentation and an update of tumor targeting with conventional and long-circulating nanoparticles. It has amassed more than 900 citations in ten years, one third of which have come in just the last two years.

Kataoka et al. of the University of Tokyo [4] published a great review on block copolymer micelles just eleven years ago. The Kataoka group is known for their imaginative work on micellar structures and this article, presently at 848 citations, is a masterful analysis of their work in the field. Another class of materials of importance in drug delivery is that of hydrogels. This very important field for drug delivery is addressed by another review from 2001 by Qiu and Park of Purdue University [5]. This fifth most cited paper has 680 citations and addresses the equally important field of environmentally sensitive hydrogels.

Panyam and Labhasetwar of the University of Nebraska at the time [6] have addressed the use of PLGA biodegradable nanoparticles for drug and gene delivery to cells and tissues, an important subject of research in the last ten years. Another contribution that addresses the biocompatibility and biodegradability of PLGA microspheres was published by Anderson and Shive of Case Western Reserve University [7] in 1997 and has more than 650 citations. The article is particularly important because it addresses the incorporation of bone-morphogenetic protein (BMP) in microspheres for important applications in tissue engineering.

In the last ten years, we have seen an explosion of the use of nanoscale structures for novel applications in drug delivery, including targeting. Two papers, by Mehnert and Mäder [8] and Svenson and Tomalia [9], discuss two areas of drug delivery that have received a number of important applications. The first paper [8] is on the use of solid–lipid nanoparticles and discusses their stability and stabilization processes by lyophilization and spray drying. The second paper [9] is an exceptionally well written review on the early days of dendrimer development, with emphasis on the classical chemical methods of dendrimer production, their conjugation with important biologicals and their applications in the field.

The use of protein PEGylation to improve protein delivery has been a subject of major interest. Harris and collaborators [10] are authorities in the field and their review paper from 2002 that has 593 citations more. It presents a complete analysis for the reasons for PEGylation, the PEG conjugation processes, and the associated results of renal filtration and biodistribution. Similarly, Williams and Barry of the University of Bradford [11] contributed an important review on penetration enhancers to improve delivery through the skin by decreasing the associated barrier resistance. This highly cited review is a lucid presentation on how to overcome some of the natural barriers of transdermal delivery. Another important subject in the use of novel delivery formulations is the identification of efflux transporters. Schinkel and Jonker of the Netherlands Cancer Institute [12] presented a detailed analysis of the ABC transporters that have a well-defined role in drug transport. The review addressed especially P-glycoproteins and multidrug resistance proteins.

☆ This preface is part of the *Advanced Drug Delivery Reviews* theme issue on "2012-Supplemental issue".

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Table 1
Highly cited publications of the journal Advanced Drug Delivery Reviews in the 1987-2012 period.

Authors	Title	Publication year	Volume	Page	Cited by Scopus	Cited by Google Scholar
Lipinski, C.A., Lombardo, F., Dominy, B.W., Feeney, P.J.	Experimental and computational approaches to estimate solubility and permeability in drug discovery and development settings	1997	23	3	2794	5519
Hoffman, A.S.	Hydrogels for biomedical applications	2002	54	3	1094	1571
Brigger, I., Dubernet, C., Couvreur, P.	Nanoparticles in cancer therapy and diagnosis	2002	54	631	910	1210
Kataoka, K., Harada, A., Nagasaki, Y.	Block copolymer micelles for drug delivery: Design, characterization and biological significance	2001	47	113	848	1363
Qiu, Y., Park, K.	Environment-sensitive hydrogels for drug delivery	2001	53	321	680	1195
Panyam, J., Labhasetwar, V.	Biodegradable nanoparticles for drug and gene delivery to cells and tissue	2003	55	329	678	1193
Anderson, J.M., Shive, M.S.	Biodegradation and biocompatibility of PLA and PLGA microspheres	1997	28	5	656	992
Mehnert, W., Mäder, K.	Solid lipid nanoparticles: Production, characterization and applications	2001	47	165	593	866
Svenson, S., Tomalia, D.A.	Dendrimers in biomedical applications — Reflections on the field	2005	57	2106	592	722
Roberts, M.J., Bentley, M.D., Harris, J.M.	Chemistry for peptide and protein PEGylation	2002	54	459	571	810
Williams, A.C., Barry, B.W.	Penetration enhancers	2004	56	603	568	686
Schinkel, A.H., Jonker, J.W.	Mammalian drug efflux transporters of the ATP binding cassette (ABC) family: An overview	2003	55	3	564	701
Jeong, B., Kim, S.W., Bae, Y.H.	Thermosensitive sol–gel reversible hydrogels	2002	54	37	563	648
Siepmann, J., Peppas, N.A.	Modeling of drug release from delivery systems based on hydroxypropyl methylcellulose (HPMC)	2001	48	139	527	709
Lawrence, M.J., Rees, G.D.	Microemulsion-based media as novel drug delivery systems	2000	45	89	516	680
Gombotz, W.R., Wee, S.F.	Protein release from alginate matrices	1998	31	267	504	652
Brannon-Peppas, L., Blanchette, J.O.	Nanoparticle and targeted systems for cancer therapy	2004	56	1649	488	700
Kreuter, J.	Nanoparticulate systems for brain delivery of drugs	2001	47	65	458	640
Hennink, W.E., Van Nostrum, C.F.	Novel crosslinking methods to design hydrogels	2002	54	13	449	585
Kwon, G.S., Kataoka, K.	Block copolymer micelles as long-circulating drug vehicles	1995	16	295	437	516
Otsuka, H., Nagasaki, Y., Kataoka, K.	PEGylated nanoparticles for biological and pharmaceutical applications	2003	55	403	412	512
Lamba, J.K., Lin, Y.S., Schuetz, E.G., Thummel, K.E.	Genetic contribution to variable human CYP3A-mediated metabolism	2002	54	1271	402	511
Rösler, A., Vandermeulen, G.W.M., Klok, H.-A.	Advanced drug delivery devices via self-assembly of amphiphilic block copolymers	2001	53	95	395	517
Artursson, P., Palm, K., Luthman, K.	Caco-2 monolayers in experimental and theoretical predictions of drug transport	2001	46	27	364	514
Stolnik, S., Illum, L., Davis, S.S.	Long circulating microparticulate drug carriers	1995	16	195	358	434
Torchilin, V.P.	Multifunctional nanocarriers	2006	58	1532	313	454
Gref, R., Domb, A., Quellec, P., Blunk, T., Muller, R.H., Verbavatz, J.M., Langer, R.	The controlled intravenous delivery of drugs using PEG-coated sterically stabilized nanospheres	1995	16	215	312	356
Kost, J., Langer, R.	Responsive polymeric delivery systems	2001	46	125	287	322
Lu, Y., Low, P.S.	Folate-mediated delivery of macromolecular anticancer therapeutic agents	2002	54	675	279	363
Jain, R.K.	Delivery of molecular and cellular medicine to solid tumors	2001	46	149	204	718

The field continues to utilize new polymers as carriers for improved delivery. The next four papers cited, with 500 or more citations, present some important drug delivery carriers. The first one by Jeong et al. of the University of Utah [13] describes the very important method of sol–gel processing for development of reversible hydrogels. This technique has been used in a wide range of drug delivery systems as it involves the development of materials with important transition mechanisms. Siepmann of the University of Lille and Peppas of the University of Texas [14] contributed a mathematical modeling paper on the details of drug delivery from hydroxy propyl methylcellulose (HPMC) products. This is an important contribution because when it was published in 2001, it was the first time that "classical" tablet-based formulations of the swellable type could be analyzed by exact mathematical expressions. The third paper by Lawrence and Rees of King's College and (then) SmithKline Beecham [15] presented a thorough analysis of microemulsion-based media for drug delivery. Finally, Gombotz and Wee of Immunex Corporation [16] addressed protein release from alginate matrices, a subject that has received significant attention since its publication in 1998.

Brannon-Peppas and Blanchette of the University of Texas [17] presented a lucid analysis of nanoparticles and targeted systems for cancer therapy. The paper attracted significant attention because of its clear presentation of targeting and methods to achieve this. Similarly, Kreuter of the Goethe University of Frankfurt [18] presented a thorough review of the blood–brain barrier and methods to improve brain delivery of drugs using nanoparticulate systems. As was said before, hydrogels continue to be a major area of study in drug delivery. An important aspect of hydrogels is the crosslinked structure and the associated crosslinking reactions. An important paper on this subject was authored by Hennink and van Nostrum of Utrecht University [19] in 2002.

Professor Kataoka of the University of Tokyo has the distinction of being the only author or coauthor of three of the twenty-five most cited papers in the field; the first one was discussed above. The contribution by Kwon and Kataoka [20] describes early results on the development of block-copolymer micelles as long-circulating vehicles for drug delivery. The contribution by Otsuka et al. [21] discusses polymeric micelles that are functionalized by PEG and can be used for delivery to specific sites.

Important contribution on biological aspects of drug delivery were given by Lamba et al. of the Universities of Memphis and Washington [22] on metabolic elimination of drugs using CHP3A enzymes and Rösler et al. of the Max Planck Institute in Mainz [23] who address pioneering work on self-assembly-based amphiphilic block copolymers.

The work of Artursson et al. from Uppsala University [24] is of major importance as it offers a lucid presentation of the importance of Caco-2 cell lines in drug transport. Their analysis stresses the predictive characteristics of these cell lines. Finally, in an influential paper from 1995 Stolnik et al. of the University of Nottingham [25] present an early view of the stealth properties of PEO modified nanoparticles in the systemic circulation.

With the permission of the editor and publisher I have finally added five influential papers that received fewer citations but are of great importance to our field as pioneering reviews. The first one is

by Torchillin of Northeastern University [26] and is the "youngest" review included in this article, published in 2006 and with more than 300 citations in six years. It addresses the importance of a wide range of nanocarriers in drug delivery, from liposomes to micelles and from polymeric nanoparticles to nanoemulsions. The group of Langer of MIT has contributed two important and highly cited reviews. The first one by Gref at el. [27] addresses the use of PEG decorated nanospheres for IV delivery, while the second by Kost and Langer [28] is one of the early pioneering contributions in responsive delivery systems.

My review of the most cited ADDR papers closes with two important subjects in drug delivery. The review by Lu and Low of Purdue University [29] addresses the importance of folic acid in anticancer therapeutic agent delivery, while the review by Jain from Harvard Medical School [30] is a thorough analysis of therapeutic delivery to solid tumors.

We marvel at the importance of these seminal publications appearing in ADDR. These review articles that follow in this volume in their fully-reproduced version, celebrate the importance of the drug delivery field in today's pharmaceutical and medical sciences and stress the importance of our work in the improvement of health care and the lives of our patients.

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