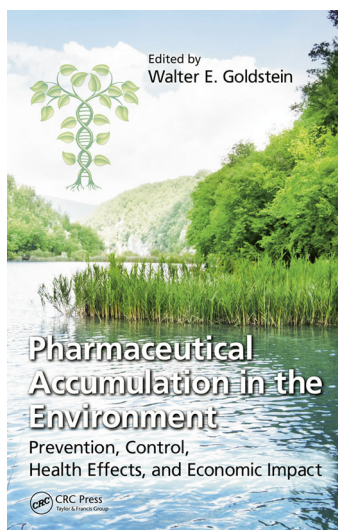


Walter E. Goldstein (Ed.): *Pharmaceutical accumulation in the environment: prevention, control, health effects, and economic impact*

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Bibliography

Pharmaceutical accumulation in the environment: prevention, control, health effects, and economic impact
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Book's topic Pharmaceuticals are a diverse group of chemicals used in veterinary medicine, agricultural practices, human health, and cosmetic care. Many are highly bioactive, most are water soluble, and—when present in the environment—they usually occur at no more than trace concentrations.

Pharmaceuticals also represent a new class of contaminants—“emerging” contaminants—that have become a source of great concern in the last few years. Human and veterinary drugs are continuously released into the environment, mainly from manufacturing processes, through the disposal of unused

or expired products, and from excreta. These are referred to as “pseudo”-persistent contaminants (i.e., the relatively fast rates of transformation/removal of these contaminants are offset by the fact that they are continuously being introduced into the environment). These contaminants are designed to produce particular biological effects; they are often moderately lipophilic, so they can cross membranes; and they are used in rather large quantities (i.e., similar to the amounts used of many pesticides).

The continuous introduction of pharmaceuticals and their bioactive metabolites into the environment may lead to high long-term concentrations and promote continual but unnoticed adverse effects on aquatic and terrestrial organisms. During the last few years, work aimed at developing a better understanding of the toxicological issues associated with such contaminants has been performed, including studies of the low-dose multi-generational exposure of organisms to multiple chemical stressors, and how humans and ecosystems may be affected by these chemical cocktails.

The book *Pharmaceutical accumulation in the environment: prevention, control, health effects, and economic impact*, edited by Walter E. Goldstein, is a very timely addition to the literature on this topic. It provides a complete overview of the presence and fate of pharmaceuticals in the environment, their health impacts, and environmental risks posed by them, and proposes remediation technologies for removing pharmaceutical residues from wastewater. The book is written by well-known experts in the field.

Contents The book is divided into ten chapters. It starts with an introduction, and then four chapters on the risks associated with drinking water. After those, there is another chapter on the occurrence and fate of illicit drugs and antibiotics in the environment. The remaining chapters of the book cover the effects of antibiotics as well as antibiotic resistance on biological wastewater treatment plants (WWTPs), as well as removal

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technologies that are applied in both WWTPs and landfills. Recommendations and research opportunities are presented in the final chapter.

Comparison with the existing literature Two recently published books that cover the same field should be mentioned. The first was published in 2010 and is entitled *Contaminants of emerging concern in the environment: ecological and human health considerations* (ACS Symposium Series 1048, 590 pages, edited by Rolf U. Halden). The second book, co-edited by myself, is entitled *Analysis, removal, effects and risks of pharmaceuticals in the water cycle. Occurrence and transformation in the environment* (Elsevier, Comprehensive Analytical Chemistry series vol. 62, published in 2013, 734 pages, edited by Mira Petrovic, Sandra Pérez, and Damia Barcelo). If we consider the number of pages in each book, it is obvious that both of those books are more comprehensive than Goldstein's book, as they both contain three times as many pages. However, Goldstein's book covers the risks to human health of exposure to pharmaceuticals through drinking water in much more detail.

Critical assessment The book contains 10 chapters that are written by well-known scientists working this field. The editor also authored half of the chapters, so the book is essentially half edited and half authored by Goldstein. Two of the chapters are written by Europeans; the rest of the book (8 chapters) are written by US scientists. The book therefore offers a largely American perspective on the problems of pharmaceuticals in drinking water. One of the key issues addressed is the health impacts of pharmaceuticals, including antibiotic resistance. In a close look at the effects of pharmaceuticals on WWTPs, the book describes the application of microscopic and imaging

methods to probe antibiotic–bioaggregate interactions. This is a novel approach to this field and could help to improve understanding of the toxicity and bioavailability of pharmaceuticals in the environment. The risks to human health from pharmaceuticals in drinking water are very well covered in this book, as they are discussed in four out of the ten chapters. A comprehensive index makes it easy for readers to consult the book on specific topics.

Readership recommendation Overall, this book will be useful to a broad spectrum of professionals, ranging from environmental chemists, ecotoxicologists, toxicologists, and engineers working in wastewater treatment plants to medical doctors who are interested in this topic. The book can also be used for teaching purposes during the academic year or at specialized summer schools for Ph.D. students who are taking courses on the risks from pharmaceutical residues in the environment to organisms and human health.

Summary The book was published at the right time. Interest in the fate and risks arising from pharmaceutical residues in the environment to organisms and human health has steadily grown in the last few years. Such risks are often discussed in the news and in press releases—I recently noticed a cartoon in a British newspaper which joked that a medical prescription should be required when ordering a glass of drinking water in a restaurant, as it may contain antibiotics! This coverage in the news implies that the general population is aware of the risk from pharmaceuticals in the water cycle. We will need to live with this risk to some extent, but Goldstein's book shows us that we can minimize it. This book will be a good addition to your library.