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Fundamentals of Analytical Toxicology

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Book Review

Fundamentals of Analytical Toxicology

By Robert J. Flanagan, Andrew Taylor, Ian D. Watson,
and Robin Whelpton

Publisher: John Wiley & Sons, Ltd. 2007.

ISBN: 978-0-470-31935-2. 505 pages.

The book consists of 505 pages of text, which is divided among 17 chapters and an index. There are also 15 pages of important introductory material covering such topics as Preface; Health and Safety; Nomenclature, Symbols, and Conventions; Amount Concentration and Mass Concentration; Acknowledgements; and List of Abbreviations. In addition, the publisher has a dedicated Web site for the book where additional material can be downloaded. The authors, throughout the text, use supporting Web site references from various organizations and sources along with the date they accessed them. A random survey of the supporting reference URLs indicated that although most of the URLs were accessible and functional, some were not. The authors appropriately cautioned the readers of this potential problem.

Each of the chapters falls logically into one of three areas: fundamental principles, specific analytical techniques, and sundry material. However, such segregation was not done by the authors. Consequently, this may create confusion for the reader. The individual chapters are well organized in an outline format, with appropriate subdivisions that adequately address the chapter's topical material. A list of references terminates each chapter and the chapter references are preceded by a terse summary. However, the term "Summary" is a misnomer in most cases. The term "Summary" leads the reader to believe that the section summarizes the content of the chapter when in reality the summaries are the author's final punctuation to and comment on the material covered in the chapter. A more suitable heading for the last section of each chapter would be "A Final Word" or "Final Comments."

It would have been helpful to the reader to have the chapters segregated into three logical sections and outlined as such in the Table of Contents. Such a grouping of the chapters would not only assist the reader in quickly locating a topic but it would also give an overall perspective of what fundamental toxicology encompasses and what topics support the fundamentals of analytical toxicology. Notwithstanding the author's comments in the Preface that the material covered in the volume is for readers who are familiar with basic analytical laboratory operation, a

more thoughtful organization and structure would make access to specific topics quicker and easier.

If the authors had given attention to the organization of the chapters into the three sections, they would have realized that Chapter 14, "Basic Laboratory Operations," is not only out of place but is also misnamed. Chapter 14 is a significant chapter addressing the word "Fundamental" in the book's title. Unfortunately, this chapter is located on pages 353 to 398 but it contains guidance in appreciating the material presented in Chapters 4 to 12 (pages 95 to 337). For example, Chapter 14 addresses such topics as preparation and storage of standard solutions, analytical errors, the distinction between accuracy and precision, calibration of standard curves, use of internal standards, and much more. The material is far too important and "fundamental" to analytical toxicology and it should be grouped with the first three chapters. Chapter 14 lays the foundation to understanding and appreciating the bulk of the material in the book and is the cornerstone to analytical toxicology.

The first section of chapters addresses the fundamental principles of analytical toxicology. This section includes Chapter 1, which is an overview of analytical toxicology. Chapter 2 describes collection, transport and storage of samples, and Chapter 3 describes preparation of samples. Finally, Chapter 14, "Basic Laboratory Operation," addresses the fundamental principles of analytical toxicology.

Chapters 4 through 12, excluding Chapter 5, comprise the second section. Chapter 5 is a short chapter that lays out the fundamental concepts of chromatography. The other eight chapters describe various analytical techniques, which include color tests, spectrophotometric and luminescence techniques, thin-layer chromatography, gas chromatography, high-performance liquid chromatography, capillary electrophoretic techniques, mass spectrometry, trace elements and toxic metals, immunoassays, and enzyme-based assays.

The third section of material in the book contains sundry material related to but not fundamental to analytical toxicology. This material includes Chapter 13—point of care testing, Chapter 15—xenobiotic disposition and metabolism, Chapter 16—pharmacokinetic analyses of xenobiotics, and Chapter 17—interpretation of analytical results for clinical applications. Although this material is important to general toxicology and puts analytical toxicology in perspective for the practicing toxicologist as well as students, it is not essential to the scope mandated by the book's title. Nonetheless, various materials in these chapters are useful but not fundamental analytical toxicology.

In spite of the disjointed organization of the chapters and the selection criteria for nonessential topics, the authors cover all of the fundamental components of analytical toxicology in a competent manner. Practical information throughout the text serves the analyst as operational guidance. In addition, the practical overtone provides foundation and background for the toxicologist who will be using the analytical data. To the casual reader, the various practical commentaries result in interesting and insightful reading.

Chapters 2 through 12 and Chapter 14 contain the book's value, and along with useful tidbits in the other chapters, add value to the core material for a general toxicologist. However, without the benefit of experience in practicing toxicology, a student may perceive an unintended emphasis on the topics that are not fundamental to analytical toxicology. In lieu of experience in toxicology, laying out the selection criteria for the ancillary topics that were covered certainly would help the inexperienced toxicologist.

For those toxicologists who are not analytical experts but who are required to critically evaluate analytical data in order to determine effect levels and no-effect levels of toxicants and make risk assessments, Chapter 14 will be an invaluable resource. Many topics covered in this chapter will help the practicing toxicologist understand the strength and limitation of the analytical results. The authors' experience and knowledge are evident not only in Chapter 14 but also in those chapters that address fundamental analytical toxicology, allowing the practicing toxicologist to make better assessments and judgments. The experienced toxicologist can address the structural and organizational flaws of the book's material by using the Index. For the inexperienced toxicologist, the absence of a structure for the essential analytical topics and the lack of criteria for selecting nonessential topics for a treatment of fundamental analytical toxicology is more of a problem.

It was not too long ago that analytical chemistry and toxicology crossed paths only on occasion. Today, the chasm has narrowed to the extent that the two disciplines are intertwined—so much so that analytical chemistry for toxicology has become simply analytical toxicology. The melding of the two disciplines will always have, as they should, their independent perspectives but the collective contribution of both is necessary to adequately address modern toxicological problems. The perspective presented in the book is one from analytical chemistry; however, the essential elements of toxicology and medical science have not been ignored.

The book, like most first editions, has its share of errors; however, few—if any—compromise the accuracy of the technical material. Now and then, the reader might have to re-read a sentence to grasp its meaning. Particularly troubling for this reviewer were different writing styles and punctuation use from chapter to chapter. However, when the book is used as a reference, the style variation will likely go undetected. There could have been better choices of examples on occasion to illustrate a point, but the examples that were chosen accomplished the author's intended objective.

Today, the practicing toxicologist is required to understand and interpret chemical analyses in the context of biologic responses in animals and humans. The quality of the toxicological judgments, risk assessments, causal relationships, etc., is directly dependent upon the quality of the analytical data as well as the toxicologist's ability to understand those data. *Fundamentals of Analytical Toxicology* assists the toxicologist in making competent health risk assessments by accurately demystifying chemical analyses. In a practical way, the book is an aid for understanding and integrating *ex vivo* chemical analyses of a toxicological investigation with the *in vivo* observations and results.

For the majority of analytical chemical issues that a toxicologist faces, the toxicologist will no longer have to consult numerous texts on analytical chemistry that were not written with the toxicologist in mind. Even those toxicologists with a chemistry background but who have been practicing toxicology for a number of years, reviewing analytical chemistry with its ever-evolving knowledge base can be laborious. The book is even more valuable to those toxicologists whose background was rooted in the biologic sciences. Students of toxicology will likely find more value in the book as a text within the structure and guidance of an academic setting.

There is a dearth of analytical texts specifically written for the practicing toxicologist. Consequently, the book will be welcomed in the resource arsenal of the practicing toxicologist. Many toxicologists will add this important reference to their libraries because it competently fills a need at an acceptable cost. Further, future editions with updates, corrections, and potential expansion of its contributor base should make this book a standard reference for the practicing toxicologist.

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