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Hans Brandenberger (Ed.) et al.

**ANALYTICAL
TOXICOLOGY FOR
CLINICAL, FORENSIC
AND PHARMACEUTICAL
CHEMISTS**

CLINICAL BIOCHEMISTRY

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**Analytical Toxicology
for Clinical, Forensic and
Pharmaceutical Chemists**

**CLINICAL
BIOCHEMISTRY**

PRINCIPLES·METHODS

APPLICATIONS

5

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Editorial

Analytical toxicology is a rather complex science. Chemists venturing into this field must possess a high degree of flexibility. They should not only have an excellent theoretical and technical knowledge of analytical chemistry, but also be prepared to look beyond the doors of their laboratories, to ensure that the submitted requests agree with the problematic, and that the results of their investigations will be interpreted correctly.

The analytical part of the work of a chemical toxicologist, which takes up his main time and effort, is complicated by several circumstances:

- Most specimens submitted for analysis are of biological nature (body fluids, tissue samples) and possess a complex matrix.
- The poisons or drugs which must be detected and quantified may be present only in minute amounts, so that microanalytical techniques have to be used.
- Often, goal and direction of a search are not clearly determined before the start of the investigation (searches for "the general unknown"). They may only become obvious during the actual work, so that strategy and pathways must progressively be adapted to the new situation.
- Toxic effects can be caused by an enormous variety of substances: metal ions, anions, gases, solvents, chemical intermediates, many classes of differently structured pesticides and drugs, as well as substances of natural origin. An analyst specialized in only a few of these fields is not the ideal toxicologist. All-rounders are needed, capable of tackling inorganic and organic problems, coping with gases and solvents, as well as with compounds possessing only minute volatility.

But even the best analytical all-rounder is not an ideal toxicologist, if he does not place his laboratory studies into a larger context. He can obtain his commission from a physician or a hospital (in clinical toxicology) or from a judge or attorney (in forensic toxicology). In both cases, the commissioner may not always be fully aware of the possibilities and difficulties inherent in the requested laboratory investigation. Furthermore, his knowledge of the dissemination and action of poisons may also be insufficient to judge all intoxication possibilities. The toxicologist must therefore possess the initiative to call for the case documentation (anamnesis, clinical or pathological data), to study this information and discuss it with the mandator, should a rectification of the analytical request seem desirable. But he can only do this, if he is well-informed about the distribution of poisons in the environment, their uses in our society, as well as their action on the body. This knowledge is likewise needed for the interpretation of the analytical data and for a correct and useful reporting of the results. In this context, a solid understanding of the resorption pathways of poisons, their metabolic fate and their excretion is equally indispensable.

Our book is intended to help a toxicologist with both aspects of his work, with the actual analytical investigation, as well as with the "side-lines" of his job, the "take-over" of an investigation from a medical or forensic authority, the interpretation of the analytical data and communication of results to the mandator.

The bulk of the book is divided into 3 main parts. Part 1 contains chapters of general nature. Various branches of toxicology are described, the history of toxicology is reviewed, and the basic principles of analytical toxicology are discussed.

cological analysis is briefly reviewed, and outlooks into new methodological possibilities made. We have abstained from including chapters describing different analytical techniques, since this information can be found in many chemical textbooks. Methods which are of special importance to toxicologists and may not be adequately treated in general analytical texts are discussed in some of the chapters in Parts 2 and 3 of the book. So contain for example:

- chapter 2.3 on ethyl alcohol and related solvents a discussion of different gas chromatographic procedures, as well as a computer program for data processing in alcohol analysis,
- chapter 2.10 on toxic metals considerable information on the role of atomic absorption analysis in inorganic toxicology,
- chapter 3.1 on barbiturates a detailed description of liquid-liquid extraction procedures in drug analysis, controlled by UV-screening of extracts,
- chapter 3.9 and 3.10 many examples for the use of mass spectrometry in the identification of drugs and metabolites,
- chapters 3.11, 3.15 and 3.16 a wealth of information on the different possibilities for immunochemical analysis.

In Part 2 of the book, the chapters dealing with the most important types of poisons have been assembled, while the main classes of drugs with toxicological importance are discussed in Part 3. This subdivision, however, has not always been observed. Chapter 2.5 on volatile chlorinated hydrocarbons presents mainly toxicological information, with emphasis on compounds of special importance in the field of medicine, while chapter 3.10 deals also with the environmental and chemical aspects of volatile halogenated hydrocarbons and includes a large number of solvents not used as anesthetics. The 2 chapters complement each other and should be studied together.

Part 4 of the book contains an up-dated list of clinical and toxicological blood drug levels, and will certainly be a welcome help for the interpretation of analytical data.

We have tried to avoid overlaps between the different chapters, unfortunately not always with success, as may be expected from a book written by a large number of authors.

We hope that the book will be of use to clinical and forensic toxicologists as well as to pharmacists involved in analytical work. The critical evaluations of the analytical possibilities may help with the choice of methods, the additional information assist in determining the goals of an investigation and in interpreting its results. - Our book is not a "cookbook" (which could anyway only have very restricted importance in the vast field of toxicology). It also does not try to list all substances of toxicological importance. Such volumes (i.e. the Merck Index and Clarke's Isolation and Identification of Drugs) already have their established place on the desk of every toxicologist and could not be replaced. Our new "Analytical Toxicology" is intended as a textbook for younger toxicologists, and as a critical review and stimulus for more experienced colleagues in the field. In addition to all analytical and toxicological information presented, it tries to teach the analytical toxicologists to see and place their technical obligations in a larger context.

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