CLINICAL GUIDE TO LABORATORY TESTS

SECOND EDITION

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Dedicated to

ABNER GOLDEN, M.D.

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University of Kentucky Medical Center
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who devoted much of his academic life to teaching
and to whom I am personally very grateful
for his kindness and support.

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Preface

During the last few decades, the use of clinical laboratory tests has grown exponentially. While older laboratory procedures have been improved or replaced with new tests, technological developments such as immunoassays, high-performance liquid chromatography, and mass spectrometry have led to the introduction of additional tests capable of measuring biological compounds in nanogram quantities. In addition, entirely new subdisciplines of laboratory medicine have emerged. As this rapidly increasing knowledge has gained entrance into a wide variety of textbooks and journals, the practicing physician—and even the laboratorian—has experienced increasing difficulty in readily locating information related to individual laboratory tests.

In an attempt to alleviate this problem, we set out to establish and compile reference ranges for most of the laboratory tests conducted in modern clinical laboratories together with information related to specimen type, stability of specimens, drug interferences, diagnostic information, and biological variables affecting the test results. Information regarding rarely performed laboratory tests was also included, because it was felt that this information is especially difficult to find.

The *Clinical Guide to Laboratory Tests* admittedly has some deficiencies because of inadequate and conflicting reports in the literature and the lack of standardization in the reporting of laboratory findings. In many cases we were able to report only the mean ± SD for certain analytes because the original authors failed to specify the range or to indicate the distribution of values. In other cases, in which conflicting information existed, it was necessary to list discrepant values with appropriate references. Thus, despite significant effort, we have been forced to report values in a nonuniform manner.

Efforts to present material in a consistent fashion will continue, however, and it is hoped that the next edition will be devoid of most of the deficiencies of the current volume. In the meantime, the editor and contributors ask for your understanding.

It is our hope that the *Clinical Guide to Laboratory Tests* will be helpful to medical practitioners and laboratorians alike in locating pertinent information regarding laboratory tests. Suggestions for improving the content or format are welcomed and will be considered during the preparation of the next edition.

NORBERT W. TIETZ
Editor

Acknowledgments

The preparation of the *Clinical Guide to Laboratory Tests* has involved a number of dedicated contributors from various disciplines and backgrounds. This effort has extended over several years and has required outstanding cooperation and understanding by these individuals. I would like to express my warmest thanks to all of them for their efforts and patience.

Ms. Michelle J. Huggins, B.A., and Judith A. Weatherholt, B.B.A., served as compositors (typesetters) for all manuscripts. Their skill, patience, and perseverance have been appreciated by all of us.

Support for this project has also been provided by many members of the Division of Clinical Chemistry at the University of Kentucky Medical Center. Some have participated as full authors; others, like Alan D. Rinker, M.S., and Joanne E. Peduzzi, B.S., have unselfishly given of their time, motivated by dedication.

Financial support for the generation of some of the experimental data included in this manual has been provided by grants from the Academic Enrichment Fund, Department of Pathology, University of Kentucky Medical Center; and the American Association of Retired Persons (AARP) Andrus Foundation, Washington, D.C.

The cooperation of the entire staff of the W.B. Saunders Company is gratefully acknowledged, especially the work by Tom Stringer, Senior Copy Editor.

NORBERT W. TIETZ
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Instructions and Comments

General Comments

The *Clinical Guide to Laboratory Tests* is divided into three main sections: Section I—General Clinical Tests: Blood Bank, Complement Factors, General and Special Clinical Chemistry, Coagulation, Hematology, Immunology, Toxicology, and Urinalysis, pp. 1-680; Section II—Therapeutic Drugs, pp. 681-764; Section III—Microbiology, pp. 765-828.

Test entries in Sections I and II are arranged alphabetically. Section III has been organized into five subsections that contain tests related to the identification of 1. bacteriological diseases; 2. spirochetal, mycoplasmal, chlamydial, and rickettsial diseases; 3. fungal diseases; 4. parasitic diseases; and 5. viral diseases. Within each of these subsections, test entries are listed alphabetically grouped by procedure (e.g. cultures, stains, serological tests).

The test index lists test names from all sections alphabetically and includes extensive cross-references. A newly added, extensive disease index cites the location of laboratory tests used in specific disease states.

In all sections, specific information related to a particular test method lines up opposite that method. Thin lines serve as guides; double lines separate complete test entries.

Column 1, Sections I, II, and III: Test Name and Method

The name of the test (analyte) is given in boldface type and is followed in parentheses by synonyms and commonly accepted abbreviations. References immediately following the test name cover general information related to the entire test entry. Beneath the test name are the designations of methods used for that test. Information lined up with each procedure is related to that procedure, and references following the method refer, in general, to all information (procedure, specimen, reference range) related to that specific method.

Information regarding patient preparation, dose requirements for test drugs, and test solutions used in the procedure (e.g., for stimulation tests), is also included where pertinent.

When the name of an entry refers to a group of analytes or organisms (e.g., complement components in Section I, or throat culture in Section III), the individual analytes (or organisms) belonging to this group are also listed in column 1.

References are given either in Column 1 (with the test method), in Column 2 (with specimen information), or in Column 3 (with the reference range), depending on the extent of the information provided in the reference.

Column 2, Sections I, II, and III: Specimens and Special Requirements

This column provides information regarding the type of specimen, anticoagulant, and the time at which the specimen should be collected. Unless otherwise specified, blood and serum specimens are drawn in the fasting state. Special instructions for collection and processing are given as necessary. When available, information regarding the stability of specimens during storage is provided.

Column 3, Sections I and II: Reference Range

Data are separated by age and sex and are marked appropriately, as are values for therapeutic and toxic drug concentrations. Values without designation are ranges for the adult population. Units for the reference range either follow the value or—to avoid repetition—appear at the top of a column of values. Sources where reference ranges can be found are frequently listed; however, if the reference range is generally accepted a reference may not be cited. Values that apply to a specific method line up with the method.

Units in brackets usually conform to the SI system (Système International d'Unités). However, in some cases the recommendations of the International Union of Pure and Applied Chemistry (IUPAC) and the Commission on World Standards of the World Association of Societies of Pathology (COWS of WASP) are used when it is felt that these units have found wider acceptance in clinical laboratories and offer advantages over the units recommended in the SI system. Factors for converting conventional units to international units are given between the two sets of ranges and, to avoid repetition, are given only with the first line of a column of values.

Column 3, Section III: Clinical Comments and Remarks

This column contains pertinent clinical and general information applicable to the use of a test procedure. Only information that has specific importance and is not general knowledge is referenced.

Column 4, Section I: Interferences

Substances that are known to interfere with a test procedure are given in this column, coded as *in vivo* (V) or chemical (C), when applicable. Chemical interferences are those that affect chemical reactions during the assay. Arrows indicate whether these interferences cause an increase or decrease in value. When several types of body fluids are discussed within the same test entry, the abbreviation preceding the arrow indicates the specimen. In Section II, Therapeutic Drugs, interferences are listed in column 6.

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Column 4, Section II: Kinetic Values

This column contains specific information about the pharmocokinetic parameters of individual drugs. When well established, parameters such as half-life, volume of distribution, and clearance are listed.

Column 5, Section I: Diagnostic Information

This column provides pertinent diagnostic information applicable to the test procedure. Clinical conditions that manifest a change either in the concentration of the analyte or in test results are listed. Arrows indicate an increase or decrease in value, and abbreviations preceding the arrows refer to the type of specimen (when applicable). Double or triple arrows indicate a more pronounced effect.

Column 5, Section II: Factors Influencing Drug Disposition

Factors such as drug elimination; drug interferences; and the effects of dialysis, pregnancy, age, and disease are listed if reasonably well-established values are available. Known drug interactions are also given.

Column 6, Sections I and II: Remarks

General information that is pertinent to the use of the test procedure is presented in this column. Only information that has specific importance and is not general knowledge is referenced. In Section II, this column also contains information related to interferences.

QUICK REFERENCE TO INFORMATION CONTAINED IN THE *CLINICAL GUIDE TO LABORATORY TESTS*—SECTION I, GENERAL CLINICAL TESTS

Test Name and Method	Specimen Requirements	Reference Range, Conventional [International Recommended Units]	Interferences
Test Name (Synonyms, Abbreviations), references related to entire entry *Method* Important assay conditions; test doses and pretest instructions	Specimen (anticoagulant). Collection times, storage information, special instructions	Generally accepted values are listed, with either a book reference or no reference. Units in brackets usually conform to the SI system (Système International d'Unités). However, units recommended by the International Union of Pure and Applied Chemistry (IUPAC) and the Commission on World Standards of the World Association of Societies of Pathology (COWS of WASP) are used when these units have found wider acceptance in clinical laboratories and offer advantages over SI units. Factors for converting conventional units to international units are placed between the two ranges and are placed only in the first line of a column of values. Values that line up with a specific procedure were determined using that method. References for these values may be given in Column 1, in Column 2, or with the reference range, depending on the extent of the information provided in the reference. Where appropriate, data are stratified by age and sex and toxic concentrations are noted. Values without designation are ranges for the adult population. Units for the reference range either follow the value or appear at the top of the column of values.	Substances and conditions listed are known to interfere with the test procedure(s). V = *in vivo* interferences C = chemical interferences Arrows indicate an increase (↑) or decrease (↓) in value. Abbreviations preceding an arrow indicate the body fluid. For key to abbreviations, see *Abbreviations*, pp. 3-7.

General comments: Information that pertains to an *entire* entry (test procedure or analyte) begins on the first line of the entry, regardless of the column in which it appears. Related information lines up across the page; thin lines serve as guides. Double lines separate entries. When the name of an entry refers to a group of analytes (e.g., complement components), the individual analytes are also listed in column 1 but are indented.

Diagnostic Information	Remarks
This column lists clinical conditions that manifest a change in the concentration of the analyte or test result. Arrows indicate an increase or a decrease in value. Abbreviations preceding an arrow indicate the specimen; two or more arrows indicate a more pronounced effect.	This column contains general information pertinent to the use of the test procedure. Only information that has specific importance and is not general knowledge is referenced.

QUICK REFERENCE TO INFORMATION CONTAINED IN THE *CLINICAL GUIDE TO LABORATORY TESTS*—SECTION II, THERAPEUTIC DRUGS

Test and Method	Specimen	Reference Range, Conventional [International Recomended Units]	Kinetic Values
Test Name (Synonyms, Abbreviations), references related to entire entry *Method*	Specimen (anticoagulant). Collection times, storage information, special instructions	Generally accepted values are listed with either a book reference or no reference. Units in brackets usually conform to the SI system (Système International d'Unités). However, units recommended by the International Union of Pure and Applied Chemistry (IUPAC) and the Commission on World Standards of the World Association of Societies of Pathology (COWS of WASP) are used when these units have found wider acceptance in clinical laboratories and offer advantages over SI units. Factors for converting conventional units to international units are placed between the two ranges and are given only in the first line of a column of values. Values that line up with a specific procedure were determined using that method. Values are given for therapeutic and toxic concentrations; peak and trough levels for each are noted where kown. Units for the reference range either follow the value or appear at the top of the column of values.	This column contains specific information about the pharmacokinetic parameters of individual drugs. Parameters such as half-life, volume of distribution, and clearance are listed when well-established values are available.

General comments: Information that pertains to an *entire* entry (test procedure or analyte) begins on the first line of the entry, regardless of the column in which it appears. Related information lines up across the page; thin lines serve as guides. Double lines separate entries.

Factors Influencing Drug Disposition

This column identifies the normal route of drug elimination. Directional arrows indicate changes in the analyte's clearance rate and half-life (↑ lengthened, ↓ shortened, → unchanged). Conditions responsible for these changes, such as chronological age, treatment protocols, or disease states, are identified. Drugs that are known to cause interactions are also identified.

Remarks Interferences

This column contains general information pertinent to the effective use of the drug, and factors affecting its laboratory measurement. Only information that has specific importance and is not general knowledge is referenced.

Also listed in this column are substances and conditions known to interfere with the test procedure(s) as well as side effects known to be associated with use of the drug.

QUICK REFERENCE TO INFORMATION CONTAINED IN THE *CLINICAL GUIDE TO LABORATORY TESTS*—SECTION III, MICROBIOLOGY

Test Name or Method	Specimens and Special Requirements	Clinical Comments and Remarks
Test Name or Organism (Synonyms, Abbreviations), references related to entire entry *Method* ***Special tests used to detect the same entity***	Specimen. Special instructions for patient preparation and specimen collection and processing	Column contains general and clinical information pertinent to the use of the test procedure. Only information that has specific importance and is not general knowledge is referenced.

General comments: Information that pertains to an *entire* entry (test procedure or analyte), regardless of the column in which it appears, begins on the first line of the entry. Related information lines up across the page. Thin lines serve as guides; double lines separate entries.

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