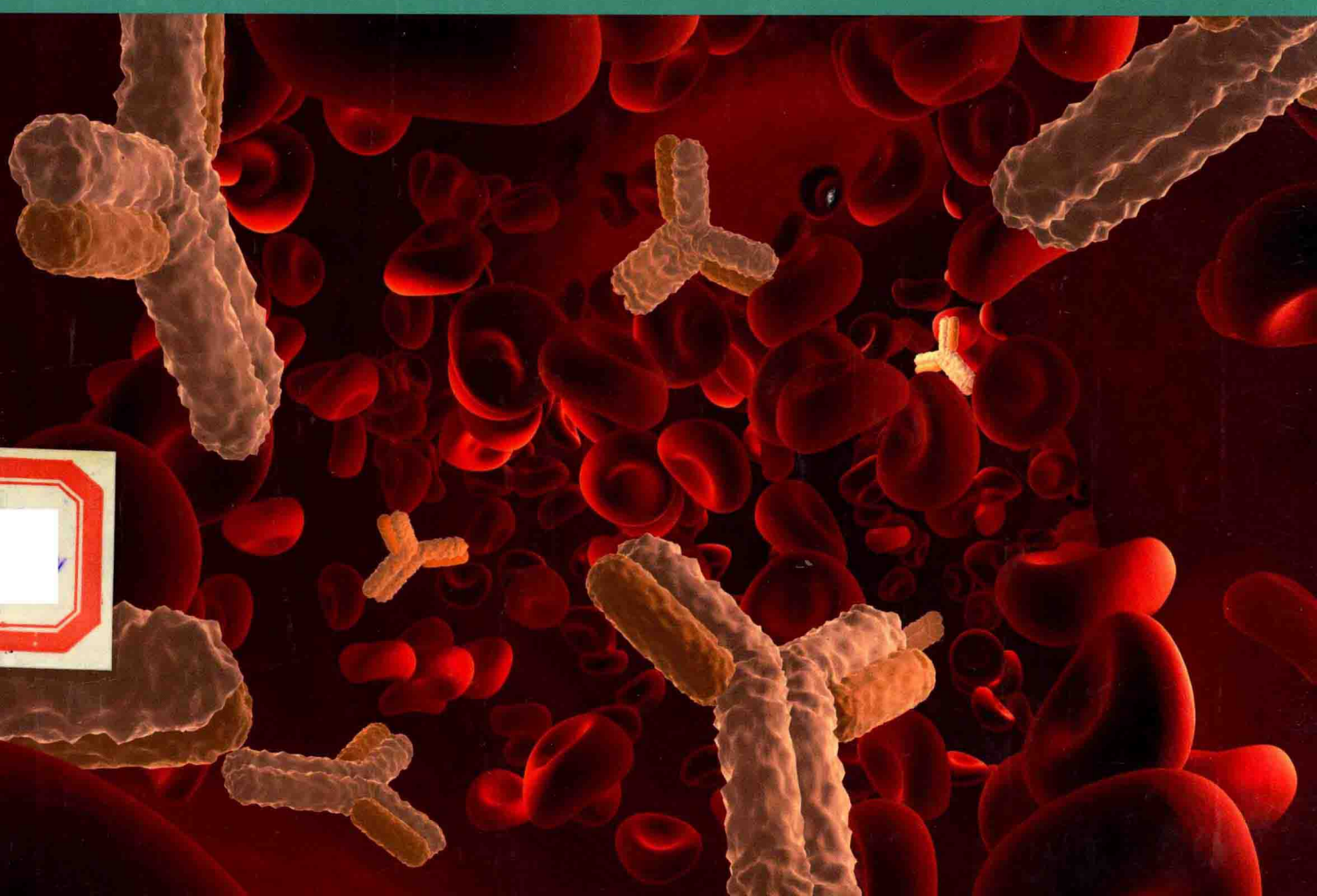
PEARSON CLINICAL LABORATORY SCIENCE SERIES

Clinical Laboratory Blood Banking and Transfusion Medicine

Principles and Practice

Johns | Gockel-Blessing | Zundel | Denesiuk



Clinical Laboratory
Blood Banking and Transfusion Medicine
Principles and Practices

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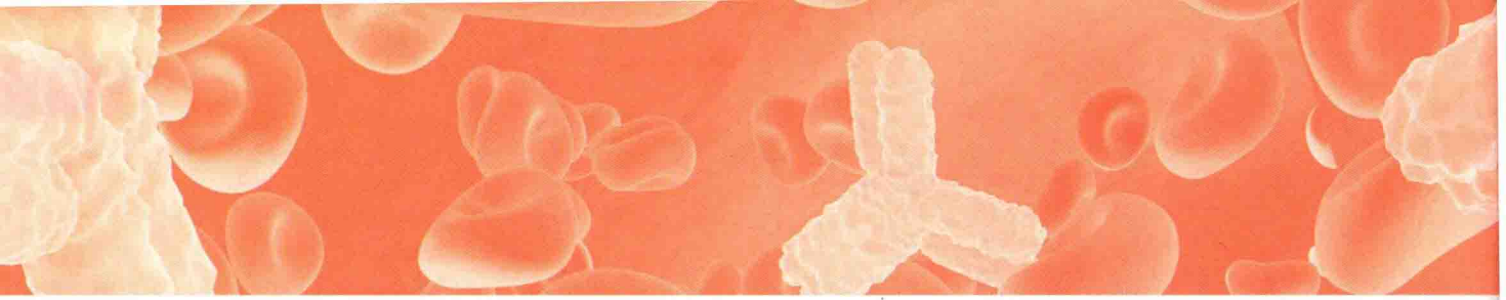
In loving memory of Linda Dolan Jasper, who set out to be the primary author of this book, designed the initial structure, and drafted several early chapters. Due to illness and her subsequent untimely death, Linda was unable to complete her part of the project. With this book, her memory lives on and her vision is realized.

To my husband, Dr. Thomas Davant Johns, for his patience and understanding while I labored on this book every weekend and during most of our vacations. Many thanks to Dr. Michael Creer and Dr. Edahn Isaak, for your examples of exceptionally high standards in teaching, integrity, and excellence in medicine and my wonderful residents and students. *—Gretchen Schaef Johns, MD*

To my entire family for their unending patience, love, and support during this entire project. Special thanks to my husband, Bob, who understood the importance of me completing my portion of this book and made numerous sacrifices to ensure that I did. He kept me focused and on track. He is indeed my "Blessing." Bob, I love you! *—Elizabeth A. Gockel-Blessing, PhD*

To my wife, Jenise, for her undying love and support and our six extraordinary children: Jason, Andrew, Taylor, Katie, Heidi, and Jacob. Special thanks to Janet Vincent for providing me with roots and wings. To all the students—past, present, and future—who make teaching and learning a daily adventure. *—Bill Zundel, MS*

For all the remarkable laboratorians out there—be proud of what you accomplish each day and be fearless in grabbing opportunities. This is dedicated to my parents, Ruth and Russ; my sister, Marci; and especially my nephew, Marlowe. *—Lisa Denesiuk, BSc*



Foreword

Clinical Laboratory Blood Banking and Transfusion Medicine is part of Pearson's Clinical Laboratory Science series of textbooks, which is designed to balance theory and practical applications in a way that is engaging and useful to students. The authors and contributors of *Clinical Laboratory Blood Banking and Transfusion Medicine* present detailed technical information and real-life case studies that help learners envision themselves as members of the health care team, providing the laboratory services specific to transfusion medicine that assist in patient care. The mixture of theoretical and practical information relating to transfusion medicine in this text allows learners to analyze and synthesize information and, ultimately, to answer questions and solve problems and cases. Additional instructional resources are available at www.pearsonhighered.com/healthprofessionsresources.

We hope that this book, as well as the entire series, proves to be a valuable educational resource.

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Preface

BACKGROUND AND PURPOSE

The laboratory discipline of transfusion medicine (also known as immunohematology or blood banking) has a rich and fascinating history. In fact, interest in the mystery surrounding the human body and the practice of bloodletting to rid the body of unwanted toxins dates back to the time period between 2500 BCE and 999 CE. It wasn't until the 17th century that the first known animal-to-animal and animal-to-human blood transfusions took place. In spite of the fact there were no recorded medical benefits, a significant number of these individuals apparently survived! Human-to-human blood transfusions were initiated and gained popularity between the 18th and early 20th centuries. Unfortunately, the success rate in these cases was marginal at best. Reasons for the high rate of blood transfusion failures began to unfold in 1901 when Dr. Karl Landsteiner discovered the existence of three different types of human blood: A, B, and C (now known as O). The fourth blood type, AB, was discovered in 1902 by two of Dr. Landsteiner's colleagues: Alfred Von DeCastello and Adriano Sturli. In the years that followed, a number of significant contributions to the field were made that are still valid today. Highlights of representative important events follow. Blood collection, processing, and storage processes were developed. Blood depots, now known as blood banks, were established. The Rh factor, named for the rhesus monkey that was used in the initial testing, along with numerous other red blood cell proteins (known as *antigens*), were discovered. Laboratory tests, procedures, and protocols designed to minimize adverse effects of blood transfusions were developed and refined. Most recently, the advent and implementation of automation in the transfusion medicine laboratory has advanced the discipline into previously uncharted territories.

Transfusion medicine is considered by many to be the area of the clinical laboratory where "life-and-death" decisions occur based on the laboratory results generated. For it is here where blood types are determined and blood is tested prior to transfusion. The goal is to prevent individuals from rejecting transfused blood that in some cases may cause a fatal reaction in a patient (a concept known as *blood incompatibility*). It is important to point out here that laboratory tests are performed *in vitro* and predict what is or will happen *in vivo* and that no test result is 100% foolproof. As long as laboratorians practice proper procedures and techniques and remain alert during the pre-examination (preanalytical), examination (analytical), and post-examination (postanalytical) phases of testing, the chances of laboratory error are greatly reduced. It is thus of paramount importance that laboratorians are educated in the theoretical and pathophysiological considerations associated with transfusion medicine testing. Furthermore, didactic and psychomotor components on specimen collection, processing and analysis, and result interpretation are critical components of effective laboratorian training. This text was developed to assist in this effort by providing readers with the didactic foundation, background, and tools to successfully function in a typical transfusion medicine laboratory.

ORGANIZATION AND FEATURES OF THE BOOK

The content of this book is organized into 21 chapters, beginning with an in-depth discussion of the origins and interactions between antigens and antibodies. The successive chapters cover the most common blood groups, pretransfusion testing protocols, donor considerations, reactions to transfusions, special populations and testing, safety and regulatory issues, and quality assurance. The book is written at a level adaptable for multiple categories of students and professionals. Instructors and readers are encouraged to utilize the sections and chapters pertinent to their needs.

Each chapter begins with a general content outline, content-specific learning objectives, and a list of key terms (and phrases). Each key term and phrase is **bold** where the term is described. References to a term or phrase prior to its description appear in the text in *italics*. A real-world "running" case study with initial questions for consideration, called ***Case In Point,*** is designed to introduce the chapter content. Subsequent installments of the "running" case study, each with pertinent questions for consideration, are strategically placed throughout the rest of the chapter. The introduction for each chapter is titled ***What's Ahead?*** and is comprised of an introductory paragraph followed by a series of questions with the answers covered in the body of the chapter. The chapter content is presented in a logical order under appropriate headings and subheadings. Periodic self-assessment questions, known as ***Checkpoints,*** are strategically placed and are designed to provide opportunities for students to evaluate their understanding of the material. Tables, figures, and boxes are incorporated into the chapters as appropriate. The text portion of each chapter concludes with a section termed ***Review of Main Points*** that consists of a bulleted list of the key "take-home" content points of the chapter. A set of review questions, each coded to the corresponding chapter learning objective, allows readers to assess their knowledge over the entire chapter content. A list of references concludes each chapter.

There are four appendices found in the back of this text, three of which consist of answers to chapter-posed questions: (1) Case In Point questions, (2) Checkpoint questions, and (3) Review questions.

The fourth appendix is comprised of an alphabetized glossary of the key terms and phrases identified within the chapters. Two features have been embedded into the glossary to assist readers. First, each glossary entry includes the one or more chapter number(s) in which the entry is designated as a key term. Second, there are numerous terms in the glossary that are synonyms. To help readers learn them, full definitions are provided for each entry with reference to the synonymous entries rather than an entry instructing the reader to look under a synonymous entry for its definition.

Although the terms Blood Bank (Banking) and Transfusion Medicine are often used interchangeably, this book primarily considers them as two different entities. Blood Bank refers to a blood collection and processing center whereas completion of the associated tasks is known as Blood Banking. Transfusion Service is the laboratory area responsible for pre-transfusion testing and blood product distribution (typically located in a hospital setting).

A COMPLETE TEACHING AND LEARNING PACKAGE

The book is complemented by a variety of ancillary materials designed to help instructors be more effective and students more successful.

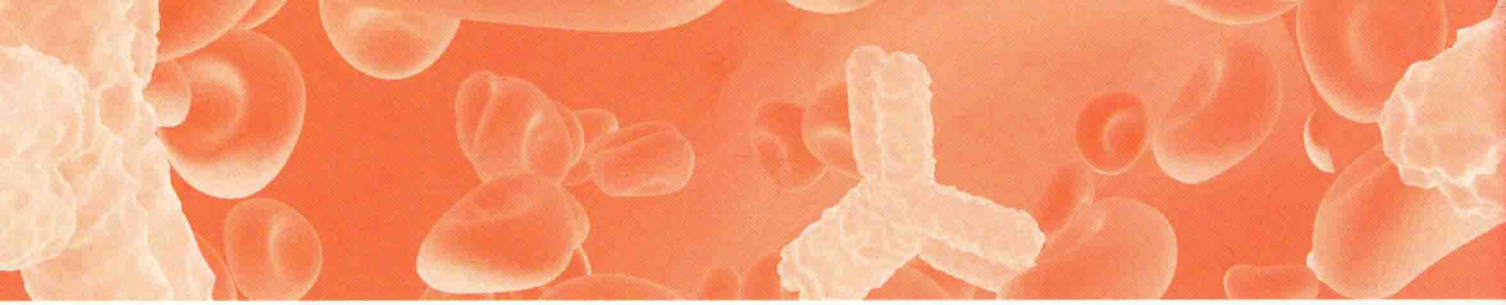
- The *Instructor's Resource Manual* is a guide designed to equip faculty with necessary teaching resources regardless of the level of instruction. Features include lecture outlines, classroom discussion questions, and suggested learning activities. The *Test Bank* includes over 400 questions to allow instructors to design customized quizzes and exams.
- The *PowerPoint Lectures* contain key discussion points, along with color images, for each chapter. This feature provides dynamic, fully designed, integrated lectures that are ready to use and allows instructors to customize the materials to meet their specific course needs.

Acknowledgments

This book was truly a team effort. The beauty of multiple editors is that whenever one of us needed assistance, which happened on many occasions, the others were *always* there to help out. Each of us put our heart and soul into this book and it was truly a pleasure working together.

The editors would like to extend their thanks to all of the authors and chapter contributors who worked tirelessly to draft and revise chapters. Special thanks to Susan Conforti for writing and refining the Chapter Objectives, Checkpoints, and Review Questions and to Stephanie Codina for writing the majority of the chapter case study entries and corresponding questions. Most of the wonderful illustrations in this text were done by our coeditor Lisa Denesiuk, who is terrifically talented. Thanks to each of the chapter reviewers who provided the team with invaluable suggestions. Thanks also to Laura Mayer who assisted on numerous logistical and clerical aspects of assembling manuscript for this book—her speed and accuracy are amazing!

We would like to especially thank Mark Cohen for his role in the approvals required to develop this book. Special thanks as well to Cynthia Mondgock who served as our developmental editor by orchestrating all of the various components and individuals associated with this book—we could not have done this without her! The other members of the book development team—Marion Waldman, Melissa Kerian, John Goucher, and everyone behind the scenes at Pearson Education—assisted the team in numerous ways throughout the process. Thanks for providing project guidance and helping to keep us on track.



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