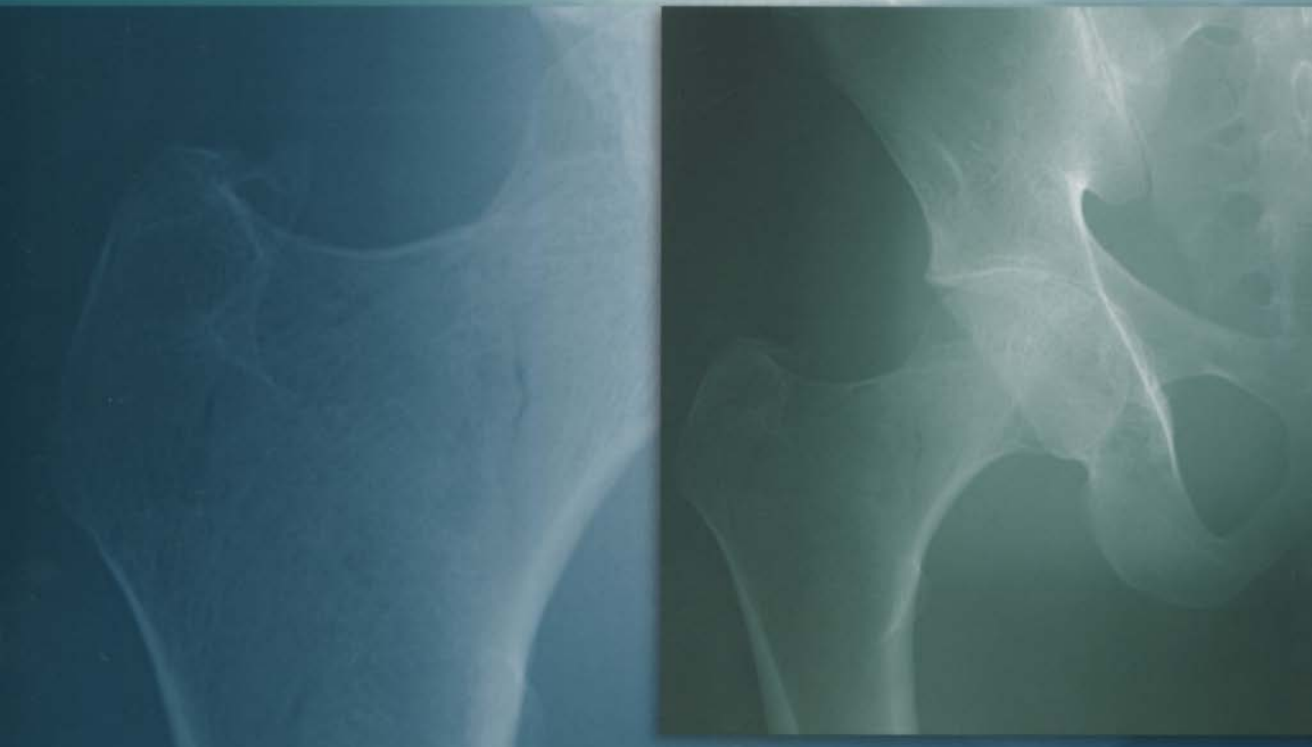
THIRD EDITION

Radiographic Imaging & Exposure



TERRI L. FAUBER

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Produce high-quality images — every time.

With an integrated presentation of digital radiography and conventional film-screen radiography, ***Radiographic Imaging & Exposure,*** **Third Edition,** provides complete coverage of the fundamental principles of imaging you need to know to produce the highest-quality images. This text also includes *Patient Protection Alerts, Practical Tips, Important Relationships,* and *Mathematical Applications* throughout the text to provide helpful information for every step of the imaging process.

This NEW Third Edition includes:

- **Expanded information and tables about quality control tests** to help you ensure that you get the best image possible every time
- ***Patient Protection Alerts*** to discuss how certain variables can impact patient exposure with tips on how to control them
- **Added information on computers and the types of digital imaging** with new illustrations in the *Digital Imaging* chapter to keep you up to date with the latest digital techniques
- ***Radiographic Film Processing*** **chapter** with even more information on image artifacts for a more comprehensive look at radiographic film
- **Bulleted summaries** at the end of each chapter that provide a quick review to ensure your understanding

Plus...

- ***UNIQUE!*** **Integrated digital radiography coverage** and a separate digital chapter include information on how to acquire, process, and display digital images.
- ***UNIQUE! Practical Tips*** demonstrate how to effectively apply concepts in clinical practice.
- ***UNIQUE! Important Relationships*** call attention to the fundamentals of radiographic imaging and exposure.
- ***UNIQUE! Mathematical Applications*** familiarize you with the mathematical formulas needed in the clinical setting.
- ***UNIQUE! Film Critique Interpretations*** teach you how to evaluate the quality of radiographic images and determine which factors contribute to image quality.

Recommended Shelving Classification
Imaging Sciences
Radiography

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Radiographic Imaging & Exposure

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PREFACE

Radiographic Imaging & Exposure takes a unique and more effective approach to teaching imaging and exposure by focusing on the practical fundamentals. With a topic such as radiographic imaging, it is impossible to depart from theoretic information entirely, and we do not want to. A concerted effort was made to present the most important and relevant information on radiographic imaging and exposure. This book highlights the practical application of theoretic information to make it more immediately useful to students and practicing radiographers alike. Our ultimate goal is to provide the knowledge to problem-solve effectively to consistently produce quality radiographic images in the clinical environment.

Who Will Benefit From This Book?

Radiographic Imaging & Exposure provides a fundamental presentation of topics that are important for students to master to be competent radiographers. Radiographers will also benefit from the practical approach to the topics of imaging and exposure presented here.

Organization

Radiographic Imaging & Exposure begins with an intriguing discussion of Wilhelm Conrad Roentgen's discovery of x-rays in 1895 and the excitement it first caused among members of nineteenth-century society, who feared that private anatomy would be exposed for all to see! This introductory chapter moves into the realm of radiologic science with discussions of x-rays as energy and the unique characteristics of x-rays. Chapter 2 continues with a more detailed discussion of the x-ray beam, which is followed by chapters on radiographic image formation (Chapter 3) and on radiographic image quality: photographic properties (Chapter 4), geometric properties (Chapter 5), scatter control (Chapter 6), and image receptors (Chapter 7). Chapter 8 is devoted to film processing and includes important considerations about the darkroom environment, film handling, and quality control. Chapter 9 provides a thorough discussion of sensitometry, including important clinical considerations. Exposure factor selection is covered in Chapter 10, and automatic exposure control is covered in Chapter 11. Chapter 12 is devoted to digital imaging, including digital fluoroscopy. This final chapter explains the process of acquiring and displaying digital images and discusses the advantages and limitations of digital and conventional film imaging processes.

Radiation exposure and imaging will continue to be a complex subject, even in the digital age. As an educator who has struggled with the dilemma of how to best incorporate digital imaging within film-screen imaging courses, I strongly believe a solid foundation in the principles of radiation exposure will best prepare the student radiographer for digital imaging.

Distinctive Features

Radiographic imaging and exposure is a complex topic, though a mastery of the fundamentals is necessary to become competent, whether you are a student or practicing radiographer. Four special features have been integrated within each chapter to facilitate the understanding and retention of the concepts under discussion and to underscore their applicability in a clinical setting. Each feature is distinguished by its own icon for easy recognition.

Important Relationships summarize the relationships being discussed in the text, as each one occurs, for immediate summary and review. The topic of radiographic imaging and exposure is replete with fundamental, important relationships, and they are emphasized in short, meaningful ways at every opportunity.

Radiographic imaging also has a strong quantitative component, and **Mathematical Applications** demonstrate the importance of mathematical formulas. This feature will help accustom you to the necessity of mastering mathematical formulas. Because they are presented with clinical scenarios, they provide an immediate application and explanation.

Practical Tips also provide immediate application of the concepts under discussion by showing how they are applied in clinical practice. The information in the chapters thus comes to life and encourages you to actively imagine how you would apply the knowledge you are learning in the classroom in a clinical setting.

Patient Protection Alerts emphasize the imaging and exposure variables that will impact the patient's radiation exposure. Because computer processing can mask exposure errors, it is even more important for radiographers to comprehend how their exposure technique choices can affect the patient.

These special features also give the practicing radiographer quick visual access to fundamental information that they need every day.

The basic concepts of digital imaging have been integrated, where appropriate, throughout the chapters in an effort to compare and contrast it to film-screen radiography. Although digital imaging systems improve the consistency in producing quality radiographic images, the radiographer still ultimately controls the amount of radiation exposure to the patient. This responsibility cannot be overemphasized.

New to this Edition

As radiography converts to digital imaging, the knowledge and skills required of radiographers will change.

- A new feature has been incorporated to prepare radiographers for this changing environment. Because computer processing can mask exposure errors, it is even more important for radiographers to comprehend how their exposure technique choices can affect the patient. *Patient Protection Alerts* have been added to emphasize the imaging and exposure variables that will impact the patient's radiation exposure. A distinguishing icon is used to alert the radiographer to the imaging variable and how it will affect the radiation exposure to the patient.
- Quality control on radiographic equipment continues to be an important aspect of radiography. Throughout relevant chapters, we have identified basic quality control tests, their purpose, and acceptable limits of performance variability. Understanding how the equipment should be performing and its method of evaluation will help reinforce important concepts in radiographic imaging and exposure.
- A new glossary has been added to aid in the users' comprehension of the terminology associated with radiographic imaging and exposure. It includes all of the key terms from each chapter.

Learning Aids

One of the primary goals of *Radiographic Imaging & Exposure* is to be a practical textbook that will prepare student radiographers for the responsibilities of radiographic imaging in a clinical setting. Every effort has been made to make the material easily accessible and understandable while remaining thorough.

- The writing style is straightforward and concise, and the textbook includes a number of features to aid in the mastery of its content, including *Important Relationships*, *Mathematical Applications*, *Practical Tips*, and *Patient Protection Alerts*.
- Each chapter ends with a series of review questions to help readers assess their comprehension of the material. An answer key is found at the back of the book.
- Relevant chapters include *Film Critique* sections that provide the opportunity to apply the science of imaging and exposure to the art of assessing actual radiographic image quality. Interpretations of the images in the *Film Critique* sections are collected in *Appendix E* for reference and discussion.
- All of the *Important Relationships*, *Mathematical Applications*, *Practical Tips*, and *Patient Protection Alerts* are also collected in separate appendixes for quick reference and review. These appendixes are organized by chapter and include page references to the appearance of each entry in the text.
- *Radiographic Imaging & Exposure* includes traditional learning aids as well. Each chapter begins with a list of objectives and key terms and concludes with

a set of multiple-choice review questions, which will help you evaluate whether you have achieved the chapter's objectives. An answer key is provided in the back of the book.

Ancillaries

For the Instructor

- Evolve Resources is an interactive learning environment designed to work in coordination with *Radiographic Imaging & Exposure*, Third Edition. It includes an instructor's manual, an image collection of approximately 235 images available in .jpeg and PowerPoint formats, a test bank in Exam View of approximately 350 questions, and web links.
  - The instructor's manual contains material that is useful for both the practiced and novice educator. Each chapter features a set of learning objectives, different from the objectives listed in the text and designed specifically for the instructor. These objectives emphasize and organize the key concepts of the chapters. The teaching strategies then provide ideas about how to help your students truly understand these concepts in addition to helping them master the stated chapter objectives. Usefulness is the key to the laboratory sections as well. The laboratory exercises accommodate different resources and instructor preferences by including both examples of predesigned experiments and additional recommended laboratory activities. Additional mathematical worksheets are included for educators to provide more practice for students if needed.
  - Instructors may use Evolve to provide an Internet-based course component that reinforces and expands the concepts presented in class. Evolve may be used to publish the class syllabus, outlines, and lecture notes; set up "virtual office hours" and e-mail communication; share important dates and information through the online class calendar; and encourage student participation through chat rooms and discussion boards. Evolve allows instructors to post exams and manage their grade books online. For more information, visit *http://evolve.elsevier.com/Fauber/radiographic/* or contact an Elsevier sales representative.

Study Aids

Wherever appropriate, we have included links in the Instructor's Manual on Evolve to *Mosby's Radiography Online: Radiographic Imaging*. This multimedia tool provides an additional resource to help in the mastery of the topics in *Radiographic Imaging & Exposure*. Mosby has developed multimedia presentations of basic physics, imaging, radiobiology, and radiation protection. These presentations are available online on Evolve.

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