

SEVENTH EDITION VOLUME TWO

Sandra L. Hagen-Ansert

# TEXTBOOK OF DIAGNOSTIC SONOGRAPHY

SEVENTH EDITION VOLUME TWO

---

# TEXTBOOK OF DIAGNOSTIC SONOGRAPHY

Sandra L. Hagen-Ansert,  
MS, RDMS, RDCS, FASE, FSDMS

Cardiology Department

Supervisor, Echo Lab

Scripps Clinic—Torrey Pines, California



with 3,463 illustrations

ELSEVIER  
MOSBY

**ELSEVIER**  
MOSBY

3251 Riverport Lane  
St. Louis, Missouri 63043

TEXTBOOK OF DIAGNOSTIC SONOGRAPHY  
Copyright © 2012 by Mosby, Inc., an affiliate of Elsevier Inc.

ISBN: 978-0-323-07301-1

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: [www.elsevier.com/permissions](http://www.elsevier.com/permissions).

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

#### Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

With respect to any drug or pharmaceutical products identified, readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of practitioners, relying on their own experience and knowledge of their patients, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

Previous editions copyrighted 2006, 2001, 1995, 1989, 1983, 1978

*Publisher:* Andrew Allen  
*Executive Editor:* Jeanne Olson  
*Developmental Editor:* Linda Woodard  
*Publishing Services Manager:* Julie Eddy  
*Project Manager:* Richard Barber  
*Design Direction:* Paula Catalano

Printed in the United States

Last digit is the print number: 9 8 7 6 5 4 3 2 1

Working together to grow  
libraries in developing countries

[www.elsevier.com](http://www.elsevier.com) | [www.bookaid.org](http://www.bookaid.org) | [www.sabre.org](http://www.sabre.org)

ELSEVIER

BOOK AID  
International

Sabre Foundation

VOLUME TWO

---

**TEXTBOOK OF**  
**DIAGNOSTIC**  
**SONOGRAPHY**

*To my daughters,  
Becca, Aly, and Kati,  
who are changing the world one day at a time*



**Joan Baker, MSR., RDMS, RDCS**  
President, Sound Ergonomics  
Kenmore, Washington

**Carolyn Coffin, MPH, RDMS,  
RDCS, RVT**  
CEO, Sound Ergonomics  
Kenmore, Washington

**Marveen Craig, RDMS**  
Diagnostic Ultrasound Consultant  
Tucson, Arizona

**M. Robert De Jong, RDMS, RDCS,  
RVT**  
Radiology Technical Manager,  
Ultrasound  
The Russell H. Morgan Department  
of Radiology  
and Radiological Science  
The Johns Hopkins Hospital  
Baltimore, Maryland

**Terry J. DuBose, MS, RDMS**  
Associate Professor and Director  
Diagnostic Medical Sonography  
Program  
University of Arkansas for Medical  
Sciences  
Little Rock, Arkansas

**Pamela Foy, M.S., RDMS**  
Clinical Instructor, Department OB/  
GYN  
The Ohio State University Medical  
Center  
Columbus, Ohio

**Candace Goldstein, BS, RDMS**  
Sonographer Educator  
Scripps Clinic Carmel Valley  
San Diego, California

**Charlotte G. Henningsen,  
MS, RT (R), RDMS, RVT**  
Chair and Professor  
Diagnostic Medical Sonography  
Department  
Florida Hospital College of Health  
Sciences  
Orlando, Florida

**Mira L. Katz, PhD, MPH**  
Associate Professor  
Division of Health Behavior and  
Health Promotion  
School of Public Health  
The Ohio State University  
Columbus, Ohio

**Fredrick Kremkau, PhD**  
Professor & Director  
Center for Medical Ultrasound  
Wake Forest University School of  
Medicine  
Winston-Salem, North Carolina

**Salvatore LaRusso, MEd, RDMS,  
RT (R)**  
Technical Director  
Penn State Hershey/ Hershey  
Medical Center  
Department of Radiology  
Hershey, Pennsylvania

**Daniel A. Merton, BS, RDMS**  
Technical Coordinator of Research  
The Jefferson Ultrasound Research  
and Educational Institute  
Thomas Jefferson University  
Philadelphia, Pennsylvania

**Carol Mitchell, PhD, RDMS,  
RDCS, RVT, RT(R)**  
Quality Assurance Coordinator,  
UW AIRP  
Program Director, University of  
Wisconsin School of Diagnostic  
Medical Ultrasound  
University of Wisconsin Hospitals  
& Clinics  
Madison, Wisconsin

**Cindy A. Owen, RT, RDMS, RVT**  
Global Luminary and Research  
Manager  
Radiology & Vascular Ultrasound  
GE Healthcare  
Memphis, Tennessee

**Mitzi Roberts, BS, RDMS, RVT**  
Chair, Assistant Professor  
Diagnostic Medical Sonography  
Program  
Baptist College of Health Science  
Memphis, Tennessee

**Jean Lea Spitz, MPH, RDMS**  
Maternal Fetal Medicine  
Foundation  
Nuchal Translucency Quality  
Review Program  
Oklahoma City, Oklahoma

**Susan Raatz Stephenson, MEd,  
BSRT-U, RDMS, RT(R)(C)**  
International Foundation for  
Sonography Education &  
Research  
AIUM communities.org  
Sandy, Utah

**Diana M. Strickland, BS,  
RDMS, RDCS**  
Clinical Assistant Professor and  
Co-Director  
Ultrasound Program  
Department of Obstetrics and  
Gynecology  
Brody School of Medicine  
East Carolina University  
Greenville, North Carolina

**Shpetim Telegrafi, M.D.**  
Assistant Professor  
Director, Diagnostic Ultrasound  
NYU School of Medicine,  
Department of Urology  
New York City, New York

**Barbara Trampe, RN, RDMS**  
Chief Sonographer  
Meriter/University of Wisconsin  
Perinatal Ultrasound  
Madison, Wisconsin

**Barbara J. Vander Werff, RDMS,  
RDCS, RVT**  
Chief Sonographer  
University of Wisconsin-Madison  
Hospitals and Clinics  
Madison, Wisconsin

**Ann Willis, MS, RDMS, RVT**  
Clinical Coordinator, Diagnostic  
Medical Sonography Program  
Baptist College of Health Sciences  
Memphis, Tennessee

**Dennis Wisher, BS, RDMS, RVT**  
Director of Education and Product  
Management  
Medison America, Inc.  
Cypress, California

**Kerry Weinberg, MS, RDMS,  
RDCS**  
Director  
Diagnostic Medical Sonography  
Program  
New York University  
New York, New York

# REVIEWERS

**Jan Blend, MS, RT(R), RDMS,  
ARDMS**

Program Coordinator, Diagnostic  
Medical Sonography  
El Centro College  
Dallas, Texas

**Katherine K. Borok, BS, RDMS,  
RDCS**

Clinical Coordinator  
American Institute of Ultrasound in  
Medicine  
Laurel, Maryland

**Joie Burns, MS, RT(R)(S), RDMS,  
RVT**

Associate Professor, Program  
Director, Diagnostic Medical  
Sonography  
Boise State University  
Boise, Idaho

**Saretta C. Craft, MS, RDCS, RVT**

Program Director, Diagnostic  
Sonography  
St. Catharine College  
St. Catharine, Kentucky

**Laura L. Currie, BS, RT(R),  
RDMS, RVT**

Clinical Coordinator  
Cape Fear Community College  
Wilmington, North Carolina

**Marianna C. Desmond, BS, RT(R),  
RDMS**

Clinical Coordinator, Diagnostic  
Medical Sonography Program  
Triton College  
River Grove, Illinois

**Jann Dolk, MA, RT(R), RDMS**

Adjunct Faculty, Diagnostic  
Medical Sonography Program  
Palm Beach State College  
Palm Beach Gardens, Florida

**Ken Galbraith, MS, RT(R), RDMS,  
RVT**

State University of New York  
Syracuse, New York

**Karen M. Having, MS Ed, RT,  
RDMS**

Associate Professor, School of  
Allied Health  
Southern Illinois  
University-Carbondale  
Carbondale, Illinois

**Bridgette Lunsford, BS, RDMS,  
RVT**

Adjunct Faculty, George  
Washington University  
Washington, D.C.

**Kasey L. Moore, ARRT, RDMS,  
RT(R) (M) (RDMS)**

Sonography Instructor  
Danville Area Community College  
Danville, Illinois

**Susan M. Perry, BS, ARDMS**

Program Director, Diagnostic  
Medical Sonography  
Owens Community College  
Toledo, Ohio

**Kellee Ann Stacks, BS, RTR,  
RDMS, RVT**

Program Director, Medical  
Sonography  
Cape Fear Community College  
Wilmington, North Carolina



## INTRODUCING THE SEVENTH EDITION

The seventh edition of *Textbook of Diagnostic Sonography* continues the tradition of excellence that began when the first edition published in 1978. Like other medical imaging fields, diagnostic sonography has seen dramatic changes and innovations since its first experimental days. Phenomenal strides in transducer design, instrumentation, color-flow Doppler, tissue harmonics, contrast agents, and 3D imaging continue to improve image resolution and the diagnostic value of sonography. The seventh edition has kept abreast of advancements in the field by having each chapter reviewed by numerous sonographers currently working in different areas of medical sonography throughout the country. Their critiques and suggestions have helped ensure that this edition includes the most complete and up-to-date information needed to meet the requirements of the modern student of sonography.

## Distinctive Approach

This textbook can serve as an in-depth resource both for students of sonography and for practitioners in any number of clinical settings, including hospitals, clinics, and private practices. Care has been taken to cultivate readers' understanding of the patient's total clinical picture even as they study sonographic examination protocol and technique. To this end, each chapter covers the following:

- Normal anatomy (including cross-sectional anatomy)
- Normal physiology
- Laboratory data and values
- Pathology
- Sonographic evaluation of an organ
- Sonographic findings
- Pitfalls in sonography
- Clinical findings
- Differential considerations

The full-color art program is of great value to the student of anatomy and pathology for sonography. Detailed line drawings illustrate the anatomic information a sonographer must know to successfully perform specific sonographic examinations. Color photographs of gross pathology help the reader visualize some of the pathology presented, and color Doppler illustrations are included where relevant.

To make important information easy to find, key points are pulled out into numerous boxes; tables throughout the chapters summarize the pathology under

discussion and break the information down into Clinical Findings, Sonographic Findings, and Differential Considerations.

Sonographic findings for particular pathologic conditions are always preceded in the text by the following special heading:

■ **Sonographic Findings.** This icon makes it very easy for students and practicing sonographers to locate this clinical information quickly.

Study and review are also essential to gaining a solid grasp of the concepts and information presented in this textbook. Learning objectives, chapter outlines, comprehensive glossaries of key terms, full references for cited material, and a list of common medical abbreviations printed on the back inside cover all help students learn the material in an organized and thorough manner.

## Scope and Organization of Topics

The *Textbook of Diagnostic Sonography* is divided into eight parts:

**Part I** introduces the reader to the foundations of sonography and patient care and includes the following:

- Basic principles of ultrasound physics and medical sonography
- Terminology frequently encountered by the sonographer
- Overview of physical findings, physiology, and laboratory data
- Patient care for the sonographer
- Ergonomics and musculoskeletal issues for practitioners
- Basics of other imaging modalities
- Image artifacts

**Part II** presents the abdomen in depth. The following topics are discussed:

- Anatomic relationships and physiology
- Abdominal scanning techniques and protocols
- Abdominal applications of ultrasound contrast agents
- Ultrasound-guided interventional techniques
- Emergent abdominal ultrasound procedures
- Separate chapters for the vascular system, the liver, gallbladder and biliary system, pancreas, gastrointestinal tract, urinary system, spleen, retroperitoneum, and peritoneal cavity and abdominal wall

**Part III** focuses on the superficial structures in the body including the breast, thyroid and parathyroid glands, scrotum, and musculoskeletal system.



**Part IV** explores sonographic examination of the neonate and pediatric patient.

**Part V** focuses on the thoracic cavity and includes:

- Anatomic and physiologic relationships within the thoracic cavity
- Echocardiographic evaluation and techniques
- Fetal echocardiography

**Part VI** comprises four chapters on extracranial and intracranial cerebrovascular imaging and peripheral arterial and venous sonographic evaluation.

**Part VII** is devoted to gynecology and includes the following topics:

- Normal anatomy and physiology of the female pelvis
- Sonographic and Doppler evaluation of the female pelvis
- Separate chapters on the pathologic conditions of the uterus, ovaries, and adnexa
- Updated chapter on the role of sonography in evaluating female infertility

**Part VIII** takes a thorough look at obstetric sonography. The following topics are discussed:

- The role of sonography in obstetrics
- Clinical ethics for obstetric sonography
- Normal first trimester and first-trimester complications
- Sonography of the second and third trimesters
- Obstetric measurements and gestational age
- Fetal growth assessment
- Prenatal diagnosis of congenital anomalies, with a separate chapter on 3D and 4D evaluation of fetal anomalies
- Chapters devoted to the placenta, umbilical cord, and amniotic fluid, as well as to the fetal face and neck, neural axis, thorax, anterior abdominal wall, abdomen, urogenital system, and skeleton

## New to This Edition

Ten new contributors joined the seventh edition to update and expand existing content, bringing with them a fresh perspective and an impressive knowledge base. They also helped contribute the more than 1000 images new to this edition, including color Doppler, 3D, and contrast-enhanced images. More than 30 new line drawings complement the new chapters found in the seventh edition.

*Essentials of Patient Care for the Sonographer* (Chapter 3) covers all aspects of patient care the sonographer may encounter, including taking and understanding vital signs, handling patients on strict bed rest, patients with tubes and oxygen, patient transfer techniques, infection control, isolation techniques, emergency medical situations, assisting patients with special needs, and patient rights.

*Ergonomics and Musculoskeletal Issues in Sonography* (Chapter 4) outlines the importance of proper

technique and positioning throughout the sonographic examination as a way to avoid long-term disability problems that may be acquired with repetitive scanning.

*Understanding Other Imaging Modalities* (Chapter 5) is a comparative overview of the multiple imaging modalities frequently encountered by the sonographer: computerized tomography, magnetic resonance, positron emission tomography (PET), nuclear medicine, and radiography.

*Artifacts in Scanning* (Chapter 6) is an outstanding review of all the artifacts commonly encountered by sonographers. There are numerous examples of the various artifacts and detailed explanations of how these artifacts are produced and how to avoid them.

*3D and 4D Evaluation of Fetal Anomalies* (Chapter 54) has a three-fold focus: (1) to introduce the sonographer to the technical concepts of 3D ultrasound; (2) to acquaint the sonographer with the 3D tools currently available; and (3) to provide clinical examples of the integration of 3D ultrasound into conventional sonographic examinations. Although a chapter with this title appeared in the last edition, this chapter has been entirely rewritten and includes all new illustrations.

## Student Resources

**Workbook.** Available for separate purchase, *Workbook for Textbook of Diagnostic Sonography* has also been completely updated and expanded. This resource gives the learner ample opportunity to practice and apply the information presented in the textbook.

- Each workbook chapter covers all the material presented in the textbook.
- Each chapter includes exercises on image identification, anatomy identification, key term definitions, and sonographic technique.
- A set of 30 case studies using images from the textbook invites students to test their skills at identifying key anatomy and pathology and describing and interpreting sonographic findings.
- Students can also test their knowledge with the hundreds of multiple choice questions found in the four exams covering different content areas: General Sonography, Pediatric, Cardiovascular Anatomy, and Obstetrics and Gynecology.

**Evolve.** On the *Evolve* site, students will find a printable list of the key terms and definitions for each chapter; a printable selected bibliography for each chapter, and Weblinks.

## Instructor Resources

Resources for instructors are also provided on the *Evolve* site to assist in the preparation of classroom lectures and activities.

- PowerPoint lectures for each chapter that include illustrations
- Test bank of 1500 multiple-choice questions in Examview and Word
- Electronic image collection that includes all the images from the textbook both in PowerPoint and in jpeg format

**Evolve Online Course Management.** *Evolve* is an interactive learning environment designed to work in coordination with *Textbook of Diagnostic Sonography*. Instructors may use *Evolve* to include an Internet-based course component that reinforces and expands upon the concepts delivered in class. *Evolve* may be used to:

- Publish the class syllabus, outlines, and lecture notes
- Set up virtual office hours and email communication
- Share important dates and information on the online class calendar
- Encourage student participation with chat rooms and discussion boards
- Post exams and manage grade books

For more information, visit <http://www.evolve.elsevier.com/HagenAnsert/diagnostic/> or contact an Elsevier sales representative.



# ACKNOWLEDGMENTS

I would like to express my gratitude and appreciation to a number of individuals who have served as mentors and guides throughout my years in sonography. Of course it all began with Dr. George Leopold at UCSD Medical Center. His quest for knowledge and his perseverance for excellence have been the mainstay of my career in sonography. I would also like to recognize Drs. Dolores Pretorius, Nancy Budorick, Wanda Miller-Hance, and David Sahn for their encouragement throughout the years at the UCSD Medical Center in both Radiology and Pediatric Cardiology.

I would also like to acknowledge Dr. Barry Goldberg for the opportunity he gave me to develop countless numbers of educational programs in sonography in an independent fashion and for his encouragement to pursue advancement. I would also like to thank Dr. Daniel Yellon for his early-hour anatomy dissection and instruction; Dr. Carson Schneck, for his excellent instruction in gross anatomy and sections of "Geraldine;" and Dr. Jacob Zutuchni, for his enthusiasm for the field of cardiology.

I am grateful to Dr. Harry Rakowski for his continued support in teaching fellows and students while I was at the Toronto Hospital. Dr. William Zwiebel encouraged me to continue writing and teaching while I was at the University of Wisconsin Medical Center, and I appreciate his knowledge, which found its way into the liver physiology section of this textbook.

My good fortune in learning about and understanding the *total patient* must be attributed to a very dedicated cardiologist, James Glenn, with whom I had the pleasure of working while I was at MUSC in Charleston, South Carolina. It was through his compassion and knowledge that I grew to appreciate the total patient beyond the transducer, and for this I am grateful.

For their continual support, feedback, and challenges, I would like to thank and recognize all the students I have taught in the various diagnostic medical sonography programs: Episcopal Hospital, Thomas Jefferson

University Medical Center, University of Wisconsin-Madison Medical Center, UCSD Medical Center, and Baptist College of Health Science. These students continually work toward the development of quality sonography techniques and protocols and have given back to the sonography community tenfold.

The continual push towards excellence has been encouraged on a daily basis by our Scripps Clinic Cardiologists and David Rubenson, Medical Director of the Echo Lab at Scripps Clinic.

The sonographers at Scripps Clinic have been invaluable in their excellent image acquisition. Special thanks to Ewa Pikulski, Megan Marks and Kristen Billick for their echocardiographic images. The general sonographers at Scripps Clinic have been invaluable in providing the excellent images for the Obstetrics and Gynecology chapters.

I would like to thank the very supportive and capable staff at Elsevier who have guided me through yet another edition of this textbook. Jeanne Olson and her excellent staff are to be commended on their perseverance to make this an outstanding textbook. Linda Woodard was a constant reminder to me to stay on task and was there to offer assistance when needed. Jennifer Moorhead has been the mainstay of this project from the beginning and has done an excellent job with the manuscript. She is to be commended on her eye for detail.

I would like to thank my family, Art, Becca, Aly, and Kati, for their patience and understanding, as I thought this edition would never come to an end.

I think that you will find the 7<sup>th</sup> Edition of the *Textbook of Diagnostic Sonography* reflects the contribution of so many individuals with attention to detail and a dedication to excellence. I hope you will find this educational experience in sonography as rewarding as I have.

Sandra L. Hagen-Ansert  
MS, RDMS, RDCS, FSDMS, FASE



## VOLUME ONE

---

### PART I Foundations of Sonography

- 1** Foundations of Sonography, 2
- 2** Introduction to Physical Findings, Physiology, and Laboratory Data, 21
- 3** Essentials of Patient Care for the Sonographer, 36
- 4** Ergonomics and Musculoskeletal Issues in Sonography, 68
- 5** Understanding Other Imaging Modalities, 78
- 6** Artifacts in Scanning, 97

### PART II Abdomen

- 7** Anatomic and Physiologic Relationships Within the Abdominal Cavity, 118
- 8** Introduction to Abdominal Scanning: Techniques and Protocols, 132
- 9** The Vascular System, 165
- 10** The Liver, 205
- 11** The Gallbladder and the Biliary System, 267
- 12** The Pancreas, 300
- 13** The Gastrointestinal Tract, 337
- 14** The Urinary System, 355
- 15** The Spleen, 422
- 16** The Retroperitoneum, 440
- 17** The Peritoneal Cavity and Abdominal Wall, 461
- 18** Abdominal Applications of Ultrasound Contrast Agents, 475
- 19** Ultrasound-Guided Interventional Techniques, 494
- 20** Emergent Abdominal Ultrasound Procedures, 528

### PART III Superficial Structures

- 21** The Breast, 549
- 22** The Thyroid and Parathyroid Glands, 588

**23** The Scrotum, 604

**24** The Musculoskeletal System, 629

#### **PART IV Neonatal and Pediatrics**

**25** Neonatal Echoencephalography, 653

**26** The Pediatric Abdomen: Jaundice and Common Surgical Conditions, 688

**27** The Neonatal and Pediatric Kidneys and Adrenal Glands, 710

**28** The Neonatal and Pediatric Pelvis, 723

**29** The Neonatal Hip, 736

**30** The Neonatal Spine, 756

### **VOLUME TWO**

---

#### **PART V The Thoracic Cavity**

**31** Anatomic and Physiologic Relationships Within the Thoracic Cavity, 773

**32** Introduction to Echocardiographic Evaluation and Technique, 785

**33** Fetal Echocardiography: Beyond the Four Chambers, 814

**34** Fetal Echocardiography: Congenital Heart Disease, 831

#### **PART VI Cerebrovascular**

**35** Extracranial Cerebrovascular Evaluation, 867

**36** Intracranial Cerebrovascular Evaluation, 883

**37** Peripheral Arterial Evaluation, 902

**38** Peripheral Venous Evaluation, 919

#### **PART VII Gynecology**

**39** Normal Anatomy and Physiology of the Female Pelvis, 938

**40** The Sonographic and Doppler Evaluation of the Female Pelvis, 955

**41** Pathology of the Uterus, 978

**42** Pathology of the Ovaries, 1001

**43** Pathology of the Adnexa, 1028

**44** The Role of Ultrasound in Evaluating Female Infertility, 1039

**PART VIII Obstetrics**

- 45** The Role of Sonography in Obstetrics, 1048
- 46** Clinical Ethics for Obstetric Sonography, 1058
- 47** The Normal First Trimester, 1064
- 48** First Trimester Complications, 1081
- 49** Sonography of the Second and Third Trimesters, 1103
- 50** Obstetric Measurements and Gestational Age, 1142
- 51** Fetal Growth Assessment by Sonography, 1158
- 52** Sonography and High-Risk Pregnancy, 1170
- 53** Prenatal Diagnosis of Congenital Anomalies, 1190
- 54** 3D and 4D Evaluation of Fetal Anomalies, 1206
- 55** The Placenta, 1220
- 56** The Umbilical Cord, 1238
- 57** Amniotic Fluid, Fetal Membranes, and Fetal Hydrops, 1249
- 58** The Fetal Face and Neck, 1267
- 59** The Fetal Neural Axis, 1289
- 60** The Fetal Thorax, 1311
- 61** The Fetal Anterior Abdominal Wall, 1323
- 62** The Fetal Abdomen, 1336
- 63** The Fetal Urogenital System, 1350
- 64** The Fetal Skeleton, 1380

VOLUME TWO

---

**TEXTBOOK OF**  
**DIAGNOSTIC**  
**SONOGRAPHY**



