

Expert **CONSULT**

Activate at expertconsult.com

**Searchable Full
Text Online**

Sleisenger and Fordtran's **Ninth Edition**
**GASTROINTESTINAL
AND LIVER DISEASE**

PATHOPHYSIOLOGY/DIAGNOSIS/MANAGEMENT

VOLUME 2



Editors

Mark Feldman, MD

Lawrence S. Friedman, MD

Lawrence J. Brandt, MD

**SAUNDERS
ELSEVIER**

Sleisenger & Fordtran's

GASTROINTESTINAL AND LIVER DISEASE



Copyright © 2010, 2006, 2002, 1998, 1993, 1989, 1983, 1978, 1973 by Saunders,
an imprint of Elsevier Inc.

Chapters 32 and 106 are in the public domain. Mayo Clinic reserves all rights to original Mayo drawings in Chapter 120.

All rights reserved. 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. Permissions may be sought directly from Elsevier's Rights Department: phone: (+1) 215 239 3804 (US) or (+44) 1865 843830 (UK); fax: (+44) 1865 853333; e-mail: healthpermissions@elsevier.com. You may also complete your request on-line via the Elsevier website at <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.

Library of Congress Cataloging-in-Publication Data

Sleisenger and Fordtran's gastrointestinal and liver disease : pathophysiology, diagnosis, management / [edited by] Mark Feldman, Lawrence S. Friedman, Lawrence J. Brandt.—9th ed.
p. ; cm.

Rev. ed. of: Sleisenger & Fordtran's gastrointestinal and liver disease / edited by Mark Feldman, Lawrence S. Friedman, Lawrence J. Brandt. 8th ed. c2006.

Includes bibliographical references and index.

ISBN 978-1-4160-6189-2

1. Gastrointestinal system—Diseases. 2. Liver—Diseases. I. Sleisenger, Marvin H.
II. Feldman, Mark, 1947- III. Friedman, Lawrence S. (Lawrence Samuel), 1953-
IV. Brandt, Lawrence J. V. Sleisenger & Fordtran's gastrointestinal and liver disease.
VI. Title: Gastrointestinal and liver disease.

[DNLM: 1. Gastrointestinal Diseases. 2. Liver Diseases. WI 140 S632 2010]

RC801.G384 2010

616.3'3—dc22

2009014222

Acquisitions Editor: Druanne Martin

Developmental Editor: Anne Snyder

Publishing Services Manager: Frank Polizzano

Project Manager: Jeff Gunning

Project Management Assistance: Lee Ann Draud, Robin Hayward

Design Direction: Steve Stave

Printed in Canada

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 | www.bookaid.org | www.sabre.org

ELSEVIER

BOOK AID
International

Sabre Foundation

Sleisenger and Fordtran's

Ninth Edition

GASTROINTESTINAL AND LIVER DISEASE

PATHOPHYSIOLOGY/DIAGNOSIS/MANAGEMENT

Mark Feldman, MD

William O. Tschumy Jr., MD, Chair of Internal Medicine
Director, Internal Medicine Residency Program
Medical Director, Research Services
Texas Health Presbyterian Hospital Dallas
Clinical Professor of Internal Medicine
University of Texas Southwestern Medical School
Dallas, Texas

Lawrence S. Friedman, MD

Professor of Medicine
Harvard Medical School
Professor of Medicine
Tufts University School of Medicine
Chair, Department of Medicine
Newton-Wellesley Hospital
Assistant Chief of Medicine
Massachusetts General Hospital
Boston, Massachusetts

Lawrence J. Brandt, MD

Professor of Medicine and Surgery
Albert Einstein College of Medicine
Emeritus Chief, Division of Gastroenterology
Montefiore Medical Center
Bronx, New York

SAUNDERS



ELSEVIER

This edition is dedicated to our grandchildren

**Noah and Jordan Feldman, Shayna and Olivia Feldgus,
Christopher Friedman, Zachary and Noah Fishkind,
and Chloe Jane King**

Contributors

Julian A. Abrams, MD

Assistant Professor of Clinical Medicine, Department of Medicine, Columbia University College of Physicians and Surgeons; Division of Digestive and Liver Diseases, Columbia University Medical Center; Cancer Epidemiology Program, Herbert Irving Comprehensive Cancer Center, New York, New York

Adenocarcinoma and Other Tumors of the Stomach

Nezam H. Afdhal, MD

Associate Professor of Medicine, Harvard Medical School; Attending Physician, Beth Israel Deaconess Medical Center, Boston, Massachusetts

Gallstone Disease

Rakesh Aggarwal, MD, DM

Additional Professor, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India

Hepatitis E

Karin L. Andersson, MD, MPH

Instructor in Medicine, Harvard Medical School; Staff Hepatologist, Gastrointestinal Unit, Massachusetts General Hospital, Boston, Massachusetts

Acalculous Biliary Pain, Acalculous Cholecystitis, Cholesterosis, Adenomyomatosis, and Polyps of the Gallbladder

Jane M. Andrews, MBBS, PhD, FRACP

Clinical Associate Professor, Department of Medicine, University of Adelaide Faculty of Health Sciences; Senior Consultant in Gastroenterology, Department of Gastroenterology and Hepatology, Royal Adelaide Hospital, Adelaide, South Australia, Australia

Small Intestinal Motor and Sensory Function and Dysfunction

Paul Angulo, MD

Professor of Medicine and Section Chief, Hepatology, Division of Digestive Diseases and Nutrition, University of Kentucky Medical Center, Lexington, Kentucky

Primary Biliary Cirrhosis

Fernando Azpiroz, MD, PhD

Professor of Medicine, Autonomous University of Barcelona; Chief, Department of Gastroenterology, University Hospital Vall d'Hebron, Barcelona, Spain

Intestinal Gas

Bruce R. Bacon, MD

James F. King, MD, Endowed Chair in Gastroenterology and Professor of Internal Medicine, Saint Louis University School of Medicine; Director, Division of Gastroenterology and Hepatology, Saint Louis University Hospital, St. Louis, Missouri

Hemochromatosis

Christina Wood Baker, PhD

Instructor in Psychiatry, Harvard Medical School; Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts

Eating Disorders

William F. Balistreri, MD

Dorothy M. M. Kersten Professor of Pediatrics and Associate Chair, Subspecialty Education, Department of Pediatrics, University of Cincinnati College of Medicine; Director Emeritus, Pediatric Liver Care Center, and Medical Director Emeritus, Liver Transplantation; Program Director, Fellowship in Transplant Hepatology, Division of Pediatric Gastroenterology, Hepatology, and Nutrition, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio

Other Inherited Metabolic Disorders of the Liver

Todd H. Baron, MD

Professor of Medicine, Mayo Clinic College of Medicine; Consultant, Gastroenterology and Hepatology, Mayo Clinic, Rochester, Minnesota

Endoscopic Treatment of Pancreatic Disease; Endoscopic and Radiologic Treatment of Biliary Disease

Bradley A. Barth, MD, MPH

Assistant Professor of Pediatrics, University of Texas Southwestern Medical School; Attending Physician, Pediatric Gastroenterology, Children's Medical Center, Dallas, Texas

Anatomy, Histology, Embryology, and Developmental Anomalies of the Pancreas

Anne E. Becker, MD, PhD, ScM

Associate Professor of Psychiatry and Associate Professor of Medical Anthropology, Harvard Medical School; Director, Eating Disorders Clinical and Research Program, Massachusetts General Hospital, Boston, Massachusetts

Eating Disorders

Alex S. Befeler, MD

Associate Professor of Internal Medicine and Medical Director for Liver Transplantation, Saint Louis University School of Medicine, St. Louis, Missouri

Tumors and Cysts of the Liver

Kfir Ben-David, MD

Assistant Professor, University of Florida College of Medicine; Chief of Minimally Invasive Gastroesophageal and Bariatric Service, Shands at University of Florida; Director of Bariatric Surgery, Malcolm Randall VA Medical Center, Gainesville, Florida

Appendicitis

L. Ashley Blackshaw, PhD

Affiliate Professor of Medicine, University of Adelaide Faculty of Health Sciences; Principal Research Fellow, Royal Adelaide Hospital, Adelaide, South Australia, Australia

Small Intestinal Motor and Sensory Function and Dysfunction

Boris Blechacz, MD, PhD

Instructor in Medicine, Mayo Clinic College of Medicine, Rochester, Minnesota

Tumors of the Bile Ducts, Gallbladder, and Ampulla

Lawrence J. Brandt, MD

Professor of Medicine and Surgery, Albert Einstein College of Medicine; Emeritus Chief, Division of Gastroenterology, Montefiore Medical Center, Bronx, New York
Vascular Lesions of the Gastrointestinal Tract; Intestinal Ischemia

George A. Bray, MD

Boyd Professor, Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, Louisiana
Obesity

Robert S. Bresalier, MD, FACP

Professor of Medicine, Birdie J. and Lydia J. Resoft Distinguished Professor in Gastrointestinal Oncology, and Director, Gastrointestinal Cancer Research Laboratory, Department of Gastroenterology, Hepatology, and Nutrition, University of Texas M. D. Anderson Cancer Center, Houston, Texas
Colorectal Cancer

Robert S. Britton, PhD

Associate Research Professor, Division of Gastroenterology and Hepatology, Saint Louis University School of Medicine; Saint Louis University Hospital, St. Louis, Missouri
Hemochromatosis

Simon J. Brookes, MD

Professor of Human Physiology, Department of Human Physiology and Center for Neuroscience, Flinders University School of Medicine, Adelaide, South Australia, Australia
Colonic Motor and Sensory Function and Dysfunction

Alan L. Buchman, MD, MSPH

Professor of Medicine and Surgery and Medical Director of Intestinal Rehabilitation/Transplant Center, Division of Gastroenterology, Northwestern University Feinberg School of Medicine, Chicago, Illinois
Short Bowel Syndrome

J. Steven Burdick, MD

Associate Professor of Medicine, University of Texas Southwestern Medical School; Staff Physician and Director of Endoscopy, Parkland Health and Hospital System; Staff Physician, Zale Lipshy University Hospital and St. Paul University Hospital, Dallas, Texas
Anatomy, Histology, Embryology, and Developmental Anomalies of the Pancreas

Robert L. Carithers, Jr., MD

Professor of Medicine, University of Washington School of Medicine; Director, Liver Care Line, and Medical Director, Liver Transplant Program, University of Washington Medical Center, Seattle, Washington
Alcoholic Liver Disease

Julie G. Champine, MD

Professor of Radiology, University of Texas Southwestern Medical School; Chief of Radiology, Parkland Health and Hospital System, Dallas, Texas
Abdominal Abscesses and Gastrointestinal Fistulas

Francis K. L. Chan, MD

Professor of Medicine, Chinese University of Hong Kong; Chief of Gastroenterology and Hepatology, Department of Medicine and Therapeutics, Prince of Wales Hospital, Hong Kong, China
Treatment of Peptic Ulcer Disease

Joseph G. Cheatham, MD

Instructor in Clinical Medicine, Uniformed Services University for Health Sciences, Bethesda, Maryland; Fellow in Gastroenterology, Walter Reed Army Medical Center, Washington, DC
Hepatitis A

Shivakumar Chitturi, MD, FRACP

Senior Staff Specialist in Gastroenterology and Hepatology, Canberra Hospital, Canberra, Australian Capital Territory, Australia
Liver Disease Caused by Drugs

Daniel C. Chung, MD

Associate Professor of Medicine, Harvard Medical School; Director, Gastrointestinal Cancer Genetics Service, Massachusetts General Hospital, Boston, Massachusetts
Cellular Growth and Neoplasia

Raymond T. Chung, MD

Associate Professor of Medicine, Harvard Medical School; Director of Hepatology and Medical Director, Liver Transplant Program, Massachusetts General Hospital, Boston, Massachusetts
Bacterial, Parasitic, and Fungal Infections of the Liver, Including Liver Abscess

Robert R. Cima, MD

Associate Professor of Surgery, Mayo Clinic College of Medicine; Consultant in Colon and Rectal Surgery, Mayo Clinic, Rochester, Minnesota
Ileostomy, Colostomy, and Pouches

Robert H. Collins, Jr., MD

Professor of Internal Medicine and Medical Oncology, University of Texas Southwestern Medical Center, Dallas, Texas
Gastrointestinal Lymphomas

Ian J. Cook, MD, FRACP

Conjoint Professor of Medicine, Department of Medicine, University of New South Wales Faculty of Medicine; Senior Staff Specialist in Gastroenterology and Director, Gastroenterology Department, St. George Hospital, Sydney, New South Wales, Australia
Colonic Motor and Sensory Function and Dysfunction

Diane W. Cox, PhD, FCCMG, FRSC

Professor of Medical Genetics, University of Alberta Faculty of Medicine, Edmonton, Alberta, Canada
Wilson Disease

Sheila E. Crowe, MD

Professor of Medicine, Division of Gastroenterology and Hepatology, University of Virginia School of Medicine, Charlottesville, Virginia
Helicobacter pylori

Albert J. Czaja, MD

Professor of Medicine, Mayo Clinic College of Medicine, Rochester, Minnesota
Autoimmune Hepatitis

Brian G. Czito, MD

Associate Professor of Radiation Oncology, Duke University School of Medicine, Durham, North Carolina
Radiation Injury

Ananya Das, MD, DM, FASGE

Professor of Medicine, Mayo Clinic College of Medicine;
Associate Chair and Director of Endoscopy, Department
of Medicine, Mayo Clinic Arizona, Scottsdale, Arizona
Tumors of the Esophagus

Fredric Daum, MD

Professor of Pediatrics and Clinical Scholar of Medicine,
Stony Brook University Medical Center School of
Medicine, Stony Brook; Chief, Division of Pediatric
Gastroenterology, Hepatology, and Nutrition, Winthrop
University Hospital, Mineola, New York
*Anatomy, Histology, Embryology, and Developmental Anomalies
of the Small and Large Intestine*

Gary L. Davis, MD

Director, General and Transplant Hepatology, Baylor
University Medical Center, Dallas, Texas
Hepatitis C

Paul A. Dawson, PhD

Professor, Department of Internal Medicine, Section of
Gastroenterology, Wake Forest University School of
Medicine, Winston-Salem, North Carolina
Bile Secretion and the Enterohepatic Circulation

Mark H. DeLegge, MD

Professor of Medicine, Medical University of South
Carolina, Charleston, South Carolina
Nutrition in Gastrointestinal Diseases

George D. Demetri, MD

Associate Professor of Medicine, Harvard Medical School;
Director, Ludwig Center at Dana-Farber/Harvard Cancer
Center, Boston, Massachusetts
Gastrointestinal Stromal Tumors (GISTs)

Kenneth R. DeVault, MD

Professor of Medicine, Mayo Clinic College of Medicine;
Chair, Division of Gastroenterology and Hepatology,
Mayo Clinic, Jacksonville, Florida
Symptoms of Esophageal Disease

Adrian M. Di Bisceglie, MD, FACP

Professor of Internal Medicine, Saint Louis University
School of Medicine, St. Louis, Missouri
Tumors and Cysts of the Liver

Philip G. Dinning, PhD

Research Fellow, Department of Medicine, University
of New South Wales Faculty of Medicine, Sydney,
New South Wales, Australia
Colonic Motor and Sensory Function and Dysfunction

Iris Dotan, MD

Lecturer, Sackler School of Medicine; Head, IBD Center,
Department of Gastroenterology and Liver Diseases,
Sovrasky Medical Center, Tel Aviv, Israel
Mucosal Immunity

Douglas A. Drossman, MD

Professor of Medicine and Psychiatry and Co-Director,
UNC Center for Functional GI and Motility Disorders,
Division of Gastroenterology and Hepatology, Univer-
sity of North Carolina School of Medicine; Attending
Physician, UNC Hospitals, Chapel Hill, North Carolina
Biopsychosocial Issues in Gastroenterology

David E. Elliott, MD, PhD

Professor and Director, Division of Gastroenterology
and Hepatology, University of Iowa Carver College of
Medicine, Iowa City, Iowa
Intestinal Infections by Parasitic Worms

B. Joseph Elmunzer, MD

Clinical Lecturer in Internal Medicine, University of
Michigan Medical School, Ann Arbor, Michigan
Biliary Tract Motor Function and Dysfunction

Grace H. Elta, MD

Professor of Medicine, University of Michigan Medical
School, Ann Arbor, Michigan
Biliary Tract Motor Function and Dysfunction

Silvia Degli Esposti, MD

Associate Clinical Professor of Medicine and Director,
Center for Gastrointestinal Services, Alpert Medical
School of Brown University, Providence, Rhode Island
Gastrointestinal and Hepatic Disorders in the Pregnant Patient

Michael B. Fallon, MD

Professor of Medicine, Dan and Lillie Sterling Professor of
Gastroenterology, and Director, Division of Gastroenter-
ology, Hepatology, and Nutrition, University of Texas
Health Science Center at Houston Medical School; Chief
of Service, Gastroenterology and Hepatology, Memorial
Hermann Medical Center, Houston, Texas
*Hepatic Encephalopathy, Hepatorenal Syndrome, Hepatopulmonary
Syndrome, and Systemic Complications of Liver Disease*

Geoffrey C. Farrell, MD, FRACP

Professor of Hepatic Medicine, Australian National
University Medical School; Gastroenterology and
Hepatology Unit, Canberra Hospital, Canberra, Austra-
lian Capital Territory, Australia
Liver Disease Caused by Drugs

James J. Farrell, MD

Associate Professor of Medicine, David Geffen School of
Medicine at UCLA; Director, Pancreaticobiliary Endos-
copy, UCLA Medical Center, Los Angeles, California
Digestion and Absorption of Nutrients and Vitamins

Richard J. Farrell, MD

Assistant Professor of Medicine, Harvard Medical School;
Associate Physician, Gastroenterology Division,
Beth Israel Deaconess Medical Center, Boston,
Massachusetts
Celiac Disease and Refractory Celiac Disease

Jordan J. Feld, MD, MPH

Assistant Professor of Medicine, University of Toronto
Faculty of Medicine; Hepatologist, University Health
Network, Toronto Western Hospital, Toronto, Ontario,
Canada
Hepatitis Caused by Other Viruses

Mark Feldman, MD

William O. Tschumy Jr., MD, Chair of Internal Medicine,
Director of Internal Medicine Residency Program, and
Medical Director of Research Services, Texas Health
Presbyterian Hospital Dallas; Clinical Professor of Inter-
nal Medicine, University of Texas Southwestern Medical
School, Dallas, Texas
Gastritis and Gastropathies

Carlos Fernández-del Castillo, MD

Associate Professor of Surgery, Harvard Medical School; Director, Pancreas and Biliary Surgery Program, Massachusetts General Hospital, Boston, Massachusetts
Tumors of the Pancreas

Lincoln E. Ferreira, MD, PhD

Director, Digestive Endoscopy Unit, University Hospital, Universidade Federal de Juiz de Fora, Juiz de Fora, Brazil
Endoscopic Treatment of Pancreatic Disease

Paul Feuerstadt, MD

Gastroenterology Fellow, Albert Einstein College of Medicine; Montefiore Medical Center, Bronx, New York
Intestinal Ischemia

Robert J. Fontana, MD

Associate Professor of Medicine and Medical Director of Liver Transplantation, University of Michigan Medical School, Ann Arbor, Michigan
Acute Liver Failure

Chris E. Forsmark, MD

Professor of Medicine and Chief, Division of Gastroenterology, Hepatology, and Nutrition, University of Florida College of Medicine, Gainesville, Florida
Chronic Pancreatitis

Jeffrey M. Fox, MD, MPH

Assistant Clinical Professor of Medicine, Division of Gastroenterology, University of California, San Francisco, School of Medicine, San Francisco; Chief, Department of Gastroenterology, Kaiser Permanente, San Rafael, California
Diverticular Disease of the Colon

Amy E. Foxx-Orenstein, DO

Associate Professor of Medicine, Mayo Clinic College of Medicine; Consultant, Division of Gastroenterology and Hepatology, Mayo Clinic, Rochester, Minnesota
Ileus and Pseudo-obstruction

Frank K. Friedenberg, MD

Professor of Medicine, Temple University School of Medicine; Attending Physician, Temple University Hospital, Philadelphia, Pennsylvania
Gastroesophageal Reflux Disease

Lawrence S. Friedman, MD

Professor of Medicine, Harvard Medical School; Professor of Medicine, Tufts University School of Medicine, Boston; Chair, Department of Medicine, Newton-Wellesley Hospital, Newton; Assistant Chief of Medicine, Massachusetts General Hospital, Boston, Massachusetts
Chronic Abdominal Pain; Acalculous Biliary Pain, Acalculous Cholecystitis, Cholesterosis, Adenomyomatosis, and Polyps of the Gallbladder

Ralph A. Gianella, MD

Mark Brown Professor of Medicine, University of Cincinnati College of Medicine; Attending Physician, University Hospital, Cincinnati, Ohio
Infectious Enteritis and Proctocolitis and Bacterial Food Poisoning

Gregory G. Ginsberg, MD

Professor of Medicine, University of Pennsylvania School of Medicine; Director of Endoscopic Services, Gastroenterology Division, University of Pennsylvania Health System, Philadelphia, Pennsylvania
Foreign Bodies, Bezoars, and Caustic Ingestions

Robert E. Glasgow, MD

Associate Professor, Department of Surgery, University of Utah School of Medicine, Salt Lake City, Utah
Treatment of Gallstone Disease

Gregory J. Gores, MD

Professor of Medicine, Mayo Clinic College of Medicine; Chair, Division of Gastroenterology and Hepatology, Mayo Clinic, Rochester, Minnesota
Tumors of the Bile Ducts, Gallbladder, and Ampulla

David A. Greenwald, MD

Associate Professor of Clinical Medicine, Albert Einstein College of Medicine; Associate Division Director, Gastroenterology, and Fellowship Program Director, Montefiore Medical Center, Bronx, New York
Protein-Losing Gastroenteropathy

Heinz F. Hammer, MD

Associate Professor of Internal Medicine and Gastroenterology, Medical University Graz; Attending Gastroenterologist, Division of Gastroenterology and Hepatology, Medical University Graz, Graz, Austria
Maldigestion and Malabsorption

William V. Harford, Jr., MD

Professor of Internal Medicine, University of Texas Southwestern Medical School; Director, Gastrointestinal Endoscopy, and Staff Physician, Veterans Affairs Medical Center, Dallas, Texas
Diverticula of the Pharynx, Esophagus, Stomach, and Small Intestine; Abdominal Hernias and Gastric Volvulus

David J. Hass, MD

Clinical Instructor, Yale University School of Medicine; Clinical Faculty, Yale-New Haven Hospital, New Haven, Connecticut
Complementary and Alternative Medicine

E. Jenny Heathcote, MB BS, MD, FRCP, FRCP(C)

Professor of Medicine, University of Toronto Faculty of Medicine; Hepatologist, University Health Network, Toronto Western Hospital, Toronto, Ontario, Canada
Hepatitis Caused by Other Viruses

Maureen Heldmann, MD

Associate Professor of Radiology, Louisiana State University Health Sciences Center School of Medicine Shreveport; Director, Body CT and MRI, Louisiana State University Health Sciences Center, Shreveport, Louisiana
Intestinal Obstruction

Christoph Högenauer, MD

Associate Professor of Internal Medicine, Medical University Graz; Attending Gastroenterologist, Division of Gastroenterology and Hepatology, Medical University Graz, Graz, Austria
Maldigestion and Malabsorption

Christopher D. Huston, MD

Associate Professor, Department of Medicine and Department of Microbiology and Molecular Genetics, University of Vermont College of Medicine; Attending Physician, Fletcher Allen Health Care, Burlington, Vermont
Intestinal Protozoa

Steven H. Itzkowitz, MD

Professor of Medicine and Director, GI Fellowship Program, Mount Sinai School of Medicine, New York, New York
Colonic Polyps and Polyposis Syndromes

Rajeev Jain, MD

Clinical Assistant Professor of Medicine, University of Texas Southwestern Medical School; Chief of Gastroenterology, Texas Health Presbyterian Hospital Dallas, Dallas, Texas

Gastrointestinal and Hepatic Manifestations of Systemic Diseases

Dennis M. Jensen, MD

Professor of Medicine, David Geffen School of Medicine at UCLA and Veterans Affairs Greater Los Angeles Healthcare System; Staff Physician, UCLA Medical Center and West Los Angeles Veterans Affairs Medical Center, Los Angeles, California

Gastrointestinal Bleeding

Robert T. Jensen, MD

Chief, Cell Biology Section, Digestive Diseases Branch, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, Maryland

Endocrine Tumors of the Pancreas and Gastrointestinal Tract

D. Rohan Jeyarajah, MD, FACS

Director of Surgical Oncology and Hepatobiliary Fellowship Program, Methodist Dallas Medical Center, Dallas, Texas

Diverticula of the Pharynx, Esophagus, Stomach, and Small Intestine; Abdominal Hernias and Gastric Volvulus

Ramon E. Jimenez, MD

Assistant Professor of Surgery, University of Connecticut Medical School, Farmington; Associate Attending Physician, Hartford Hospital, Hartford, Connecticut

Tumors of the Pancreas

Ellen Kahn, MD

Professor of Pathology and Pediatrics, New York University School of Medicine, New York; Director of Laboratories, North Shore Gastroenterology Associates PC, Great Neck, New York

Anatomy, Histology, Embryology, and Developmental Anomalies of the Small and Large Intestine

Peter J. Kahrilas, MD

Gilbert H. Marquardt Professor in Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois

Esophageal Neuromuscular Function and Motility Disorders

Patrick S. Kamath, MD

Professor of Medicine, Mayo Clinic College of Medicine, Rochester, Minnesota

Portal Hypertension and Gastrointestinal Bleeding

David A. Katzka, MD

Professor of Medicine, University of Pennsylvania School of Medicine; Division of Gastroenterology, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania

Esophageal Disorders Caused by Medications, Trauma, and Infection

Jonathan D. Kaunitz, MD

Professor of Medicine, David Geffen School of Medicine at UCLA; Staff Physician, West Los Angeles Veterans Affairs Medical Center, Los Angeles, California

Gastric Secretion

Ciarán P. Kelly, MD

Professor of Medicine, Harvard Medical School; Chief, Blumgart Internal Medicine Firm, and Director, Gastroenterology Fellowship Training, Beth Israel Deaconess Medical Center, Boston, Massachusetts

Celiac Disease and Refractory Celiac Disease; Antibiotic-Associated Diarrhea, Pseudomembranous Enterocolitis, and Clostridium difficile-Associated Diarrhea and Colitis

Seema Khan, MB BS

Associate Professor of Pediatrics, Jefferson Medical College of Thomas Jefferson University, Philadelphia, Pennsylvania; Pediatric Gastroenterologist, Nemours/Alfred I. duPont Hospital for Children, Wilmington, Delaware

Eosinophilic Disorders of the Gastrointestinal Tract

Arthur Y. Kim, MD

Assistant Professor of Medicine, Harvard Medical School; Assistant in Medicine, Infectious Diseases Unit, Massachusetts General Hospital, Boston, Massachusetts

Bacterial, Parasitic, and Fungal Infections of the Liver, Including Liver Abscess

Michael B. Kimmey, MD

Clinical Professor of Medicine, University of Washington School of Medicine, Seattle; President, Tacoma Digestive Disease Center, Tacoma, Washington

Complications of Gastrointestinal Endoscopy

Kenneth L. Koch, MD

Professor of Medicine and Chief, Section on Gastroenterology, and Director, Digestive Health Center, Wake Forest University School of Medicine, Winston-Salem, North Carolina

Gastric Neuromuscular Function and Neuromuscular Disorders

Kris V. Kowdley, MD

Clinical Professor of Medicine and Director, Center for Liver Disease, Virginia Mason Medical Center, Seattle, Washington

Sclerosing Cholangitis and Recurrent Pyogenic Cholangitis

Krzysztof Krawczynski, MD, PhD

Distinguished Consultant and Team Leader, Centers for Disease Control and Prevention, Atlanta, Georgia

Hepatitis E

Robert C. Kurtz, MD

Professor of Clinical Medicine, Weill Medical College of Cornell University; Chief, Gastroenterology-Nutrition Service, and Attending Physician, Department of Medicine, Memorial Sloan-Kettering Cancer Center, New York, New York

Tumors of the Small Intestine

J. Thomas Lamont, MD

Professor of Medicine, Harvard Medical School; Chief of Gastroenterology, Beth Israel Deaconess Medical Center, Boston, Massachusetts

Antibiotic-Associated Diarrhea, Pseudomembranous Enterocolitis, and Clostridium difficile-Associated Diarrhea and Colitis

Charles S. Landis, MD, PhD

Fellow in Transplant Hepatology, University of Washington, Seattle, Washington

Vascular Lesions of the Gastrointestinal Tract

Anne M. Larson, MD, FACP

Associate Professor of Internal Medicine and Medical Director of Liver Transplant Program, University of Texas Southwestern Medical Center, Dallas, Texas
Gastrointestinal and Hepatic Complications of Solid Organ and Hematopoietic Cell Transplantation

James Y. W. Lau, MD

Professor of Surgery, Chinese University of Hong Kong; Director of Endoscopy, Endoscopy Centre, Prince of Wales Hospital, Hong Kong, China
Treatment of Peptic Ulcer Disease

Edward L. Lee, MD

Professor and Chair, Department of Pathology, Howard University College of Medicine; Howard University Hospital, Washington, DC
Gastritis and Gastropathies

Anthony J. Lembo, MD

Associate Professor of Medicine, Harvard Medical School; Physician, Beth Israel Deaconess Medical Center, Boston, Massachusetts
Constipation

Mike A. Leonis, MD, PhD

Assistant Professor of Pediatrics, University of Cincinnati College of Medicine; Staff Physician, Division of Gastroenterology, Hepatology, and Nutrition, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio
Other Inherited Metabolic Disorders of the Liver

Michael D. Levitt, MD

Professor of Medicine, University of Minnesota Medical School; Staff Physician, Minneapolis Veterans Affairs Medical Center, Minneapolis, Minnesota
Intestinal Gas

James H. Lewis, MD, FACP, FACC

Professor of Medicine, Georgetown University School of Medicine; Director of Hepatology, Georgetown University Hospital, Washington, DC
Liver Disease Caused by Anesthetics, Toxins, and Herbal Preparations

Hsiao C. Li, MD

Assistant Professor of Internal Medicine-Hepatology/Oncology, University of Texas Southwestern Medical School, Dallas, Texas
Gastrointestinal Lymphomas

Gary R. Lichtenstein, MD

Professor of Medicine, University of Pennsylvania School of Medicine; Director, Center for Inflammatory Bowel Diseases, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania
Ulcerative Colitis

Rodger A. Liddle, MD

Professor of Medicine, Duke University School of Medicine; Chief, Division of Gastroenterology, Duke University Hospital, Durham, North Carolina
Gastrointestinal Hormones and Neurotransmitters

Steven D. Lidofsky, MD, PhD

Professor of Medicine and Pharmacology, University of Vermont College of Medicine; Director of Hepatology, Fletcher Allen Health Care, Burlington, Vermont
Jaundice

Keith D. Lindor, MD

Professor of Medicine, Mayo Clinic College of Medicine, Rochester, Minnesota
Primary Biliary Cirrhosis

Caroline Loeser, MD

Assistant Professor of Medicine, Section of Digestive Diseases, Yale University School of Medicine; Attending Physician, Yale-New Haven Hospital, New Haven, Connecticut
Ulcers of the Small and Large Intestine

John D. Long, MD

Associate Professor of Medicine, Wake Forest University School of Medicine; Director, GI Neuromuscular Disorders Program, Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina
Anatomy, Histology, Embryology, and Developmental Anomalies of the Esophagus

Mark E. Lowe, MD, PhD

Professor of Pediatrics, University of Pittsburgh School of Medicine; Chief, Pediatric Gastroenterology, Hepatology, and Nutrition, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, Pennsylvania
Hereditary, Familial, and Genetic Disorders of the Pancreas and Pancreatic Disorders in Childhood

Emmy Ludwig, MD

Assistant Professor of Clinical Medicine, Weill Medical College of Cornell University; Assistant Attending Physician, Gastroenterology-Nutrition Service, Department of Medicine, Memorial Sloan-Kettering Cancer Center, New York, New York
Tumors of the Small Intestine

Matthias Maiwald, MD

Associate Professor of Medical Microbiology, Department of Microbiology and Infectious Diseases, Flinders University School of Medicine, Northern Territory Clinical School; Director of Microbiology, Department of Pathology, Royal Darwin Hospital, Tiwi, Northern Territory, Australia
Whipple's Disease

Carolina Malagelada, MD

Research Associate, Autonomous University of Barcelona; Staff Physician, Digestive Diseases Department, Vall d'Hebron University Hospital, Barcelona, Spain
Nausea and Vomiting

Juan-R. Malagelada, MD

Professor, Autonomous University of Barcelona; Chair, Digestive Diseases Department, Vall d'Hebron University Hospital, Barcelona, Spain
Nausea and Vomiting

Peter W. Marcelllo, MD, FACS, FASCRS

Vice Chair, Department of Colon and Rectal Surgery, Lahey Clinic, Burlington, Massachusetts
Diseases of the Anorectum

Lawrence A. Mark, MD, PhD

Assistant Professor of Dermatology and Charles W. Lewis Investigator, Indiana University School of Medicine; Wishard Dermatology Chief, Wishard Health Services, Indianapolis, Indiana
Oral Diseases and Oral-Cutaneous Manifestations of Gastrointestinal and Liver Disease

Paul Martin, MD

Professor of Medicine and Chief, Division of Hepatology, University of Miami Leonard M. Miller School of Medicine, Miami, Florida
Liver Transplantation

Joel B. Mason, MD

Professor of Medicine and Nutrition, Tufts University School of Medicine; Staff Physician, Divisions of Gastroenterology and Clinical Nutrition, Tufts University Medical Center, Boston, Massachusetts
Nutritional Assessment and Management of the Malnourished Patient

Jeffrey B. Matthews, MD

Christian R. Holmes Professor and Chair, Department of Surgery, University of Cincinnati College of Medicine, Cincinnati, Ohio
Surgical Peritonitis and Other Diseases of the Peritoneum, Mesentery, Omentum, and Diaphragm

Lloyd Mayer, MD

Professor and Chair, Immunology Institute; Chief, Henry Janowitz Division of Gastroenterology; and Chief, Division of Clinical Immunology, Mount Sinai School of Medicine, New York, New York
Mucosal Immunity

Craig J. McClain, MD

Professor of Medicine, Professor of Pharmacology and Toxicology, and Associate Vice President for Translational Research, University of Louisville School of Medicine; Chief of Gastroenterology, Louisville Veterans Affairs Medical Center, Louisville, Kentucky
Alcoholic Liver Disease

George B. McDonald, MD

Professor of Medicine, University of Washington School of Medicine; Member and Head, Gastroenterology/Hepatology Section, Fred Hutchinson Cancer Research Center, Seattle, Washington
Gastrointestinal and Hepatic Complications of Solid Organ and Hematopoietic Cell Transplantation

Frederick H. Millham, MD

Associate Clinical Professor of Surgery, Harvard Medical School; Chair, Department of Surgery, Newton-Wellesley Hospital, Newton, Massachusetts
Acute Abdominal Pain

Joseph P. Minei, MD, MBA

Professor and Chair, Division of Burn, Trauma, and Critical Care, Department of Surgery, University of Texas Southwestern Medical Center; Surgeon-in-Chief, Parkland Health and Hospital System, Dallas, Texas
Abdominal Abscesses and Gastrointestinal Fistulas

Ginat W. Mirowski, DMD, MD

Adjunct Associate Professor, Indiana University School of Dentistry, Indianapolis, Indiana
Oral Disease and Oral-Cutaneous Manifestations of Gastrointestinal and Liver Disease

Joseph Misdradi, MD

Assistant Professor of Pathology, Harvard Medical School; Assistant Pathologist, Massachusetts General Hospital, Boston, Massachusetts
Embryology, Anatomy, Histology, and Developmental Anomalies of the Liver

John Morton, MD, MPH

Associate Professor of Surgery, Director of Bariatric Surgery and Surgical Quality, and Section Chief of Minimally Invasive Surgery, Stanford University School of Medicine, Stanford, California
Bariatric Surgery

Sean J. Mulvihill, MD

Professor and Chair, Department of Surgery, and Ross Anderson Presidential Endowed Chair in Surgery, University of Utah School of Medicine; Senior Director for Clinical Affairs, Huntsman Cancer Institute, University of Utah, Salt Lake City, Utah
Treatment of Gallstone Disease

Moises Ilan Nevah, MD

Assistant Professor of Medicine, University of Texas Health Science Center at Houston Medical School, Houston, Texas
Hepatic Encephalopathy, Hepatorenal Syndrome, Hepatopulmonary Syndrome, and Systemic Complications of Liver Disease

Jeffrey A. Norton, MD

Professor of Surgery, Stanford University School of Medicine; Chief, Surgical Oncology, Stanford University Medical Center, Stanford, California
Endocrine Tumors of the Pancreas and Gastrointestinal Tract

Kjell Öberg, MD, PhD

Professor of Endocrine Oncology, Department of Medical Sciences, Uppsala University; Chair, Center of Excellence Endocrine Tumors, Department of Endocrine Oncology, University Hospital, Uppsala, Sweden
Gastrointestinal Carcinoid Tumors (Gastrointestinal Neuroendocrine Tumors) and the Carcinoid Syndrome

Jacqueline G. O'Leary, MD, MPH

Medical Director, Inpatient Liver and Transplant Unit, Baylor University Medical Center, Dallas, Texas
Hepatitis C

Seamus O'Mahony, MD, FRCP

Senior Lecturer in Gastroenterology, University College Cork, National University of Ireland; Consultant Gastroenterologist, Cork University Hospital, Cork, Ireland
Enteric Microbiota and Small Intestinal Bacterial Overgrowth

Susan R. Orenstein, MD

Professor Emerita, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania
Eosinophilic Disorders of the Gastrointestinal Tract

Roy C. Orlando, MD

Mary Kay and Eugene Bozyski and Linda and William Heizer Distinguished Professor of Medicine and Adjunct Professor of Cell and Molecular Physiology, University of North Carolina School of Medicine, Chapel Hill, North Carolina
Anatomy, Histology, Embryology, and Developmental Anomalies of the Esophagus

Mark T. Osterman, MD, MSCE

Assistant Professor of Medicine, University of Pennsylvania School of Medicine; Division of Gastroenterology, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania
Ulcerative Colitis

Stephen J. Pandol, MD

Professor of Medicine, David Geffen School of Medicine at UCLA; Staff Physician, Veterans Affairs Greater Los Angeles Healthcare System, Los Angeles, California
Pancreatic Secretion

John E. Pandolfino, MD

Associate Professor of Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois
Esophageal Neuromuscular Function and Motility Disorders

Abhitabh Patil, MD

Assistant Professor of Medicine, Rush University Medical Center, Chicago, Illinois
Vascular Diseases of the Liver

John H. Pemberton, MD

Professor of Surgery, Mayo Clinic College of Medicine; Consultant in Colon and Rectal Surgery, Rochester, Minnesota
Ileostomy, Colostomy, and Pouches

V. S. Periyakoil, MD

Director, Stanford University Hospice and Palliative Medicine Fellowship Program, Stanford University School of Medicine; Associate Director of Palliative Care Services, Veterans Affairs Palo Alto Health Care System, Palo Alto, California
Palliative Care for Patients with Gastrointestinal and Hepatic Disease

Robert Perrillo, MD

Associate Director, Hepatology Division, and Director, Transplant Hepatology Fellowship, Baylor University Medical Center, Dallas, Texas
Hepatitis B and D

David A. Peura, MD

Emeritus Professor of Medicine, Division of Gastroenterology and Hepatology, University of Virginia School of Medicine, Charlottesville, Virginia
Helicobacter pylori

Patrick R. Pfau, MD

Associate Professor of Medicine, Section of Gastroenterology and Hepatology, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin
Foreign Bodies, Bezoars, and Caustic Ingestions

Daniel K. Podolsky, MD

Professor of Internal Medicine, Doris and Bryan Wildenthal Distinguished Chair in Medical Science, and President, University of Texas Southwestern Medical Center, Dallas, Texas
Cellular Growth and Neoplasia

Jonathan Potak, MD

Assistant Professor of Medicine, Mount Sinai School of Medicine, New York, New York
Colonic Polyps and Polyposis Syndromes

Daniel S. Pratt, MD

Assistant Professor of Medicine, Harvard Medical School; Liver-Biliary-Pancreas Center, Massachusetts General Hospital, Boston, Massachusetts
Liver Chemistry and Function Tests

Deborah Denise Proctor, MD

Professor of Medicine and Director, Inflammatory Bowel Disease Program, Section of Digestive Diseases, Yale University School of Medicine; Attending Physician, Yale-New Haven Hospital, New Haven, Connecticut
Ulcers of the Small and Large Intestine

B. S. Ramakrishna, MD, DM, PhD

Professor of Gastroenterology, Christian Medical College, Vellore, Tamil Nadu, India
Tropical Diarrhea and Malabsorption

Mrinalini C. Rao, PhD

Professor and Vice President of Faculty Affairs, Department of Physiology and Biophysics, University of Illinois College of Medicine at Chicago, Chicago, Illinois
Intestinal Electrolyte Absorption and Secretion

Satish S. C. Rao, MD, PhD, FRCP(Lon)

Professor of Medicine, University of Iowa Carver College of Medicine; Director, Neurogastroenterology and Gastrointestinal Motility, University of Iowa Hospitals and Clinics, Iowa City, Iowa
Fecal Incontinence

Andrea E. Reid, MD, MPH

GI/Hepatology/Nutrition Section, Veteran Affairs Medical Center, Washington, DC
Nonalcoholic Fatty Liver Disease

John F. Reinus, MD

Professor of Clinical Medicine, Albert Einstein College of Medicine; Chief of Clinical Hepatology, Montefiore Medical Center, Bronx, New York
Gastrointestinal and Hepatic Disorders in the Pregnant Patient

David A. Relman, MD

Professor of Medicine and Professor of Microbiology and Immunology, Stanford University School of Medicine; Chief, Infectious Diseases Section, Veterans Affairs Palo Alto Health Care System, Palo Alto, California
Whipple's Disease

Joel E. Richter, MD

Richard L. Evans Chair and Professor, Department of Medicine, Temple University School of Medicine, Philadelphia, Pennsylvania
Gastroesophageal Reflux Disease

Eve A. Roberts, MD, FRCPC

Adjunct Professor of Pediatrics, Medicine, and Pharmacology, University of Toronto Faculty of Medicine; Associate, Division of Gastroenterology, Hepatology, and Nutrition, Hospital for Sick Children, Toronto, Ontario, Canada
Wilson Disease

Hugo R. Rosen, MD, FACP

Waterman Endowed Chair in Liver Research, Professor of Medicine and Immunology, Division Head of Gastroenterology and Hepatology, and Program Director, Hepatitis C Research Center, University of Colorado Denver Health Sciences Center, Denver, Colorado
Liver Transplantation

Andrew S. Ross, MD

Digestive Disease Institute, Virginia Mason Medical Center, Seattle, Washington
Sclerosing Cholangitis and Recurrent Pyogenic Cholangitis

Jayanta Roy-Chowdhury, MD

Professor of Medicine and Genetics, Albert Einstein College of Medicine, Bronx, New York
Liver Physiology and Energy Metabolism

Namita Roy-Chowdhury, MD

Professor of Medicine and Genetics, Albert Einstein College of Medicine, Bronx, New York
Liver Physiology and Energy Metabolism

Bruce A. Runyon, MD

Professor of Medicine, Division of Gastroenterology and Hepatology, Loma Linda University School of Medicine; Chief of Liver Service, Loma Linda University Medical Center, Loma Linda, California

Ascites and Spontaneous Bacterial Peritonitis

Michael A. Russo, MD

Assistant Professor of Pediatrics, Division of Pediatric Gastroenterology, Hepatology, and Nutrition, University of Texas Southwestern Medical School, Dallas; Attending Physician, Children's Medical Center of Dallas at Legacy, Plano, Texas

Anatomy, Histology, Embryology, and Developmental Anomalies of the Stomach and Duodenum

Hugh A. Sampson, MD

Professor of Pediatrics and Immunology, Mount Sinai School of Medicine; Staff Physician, Mount Sinai Hospital, New York, New York

Food Allergies

Bruce E. Sands, MD

Associate Professor of Medicine, Harvard Medical School; Interim Chief, Gastrointestinal Unit, and Medical Co-Director, MGH Crohn's and Colitis Center, Massachusetts General Hospital, Boston, Massachusetts

Crohn's Disease

George A. Sarosi, Jr., MD

Associate Professor of Surgery, Robert H. Hux, MD, Professor of Surgery, and Surgical Residency Program Director, University of Florida College of Medicine; Assistant Chief, Surgical Service, North Florida/South Georgia Veterans Affairs Medical Center, Gainesville, Florida

Appendicitis

Thomas J. Savides, MD

Professor of Clinical Medicine, University of California, San Diego, School of Medicine; Clinical Service Chief, Gastroenterology, University of California, San Diego, Medical Center, La Jolla, California

Gastrointestinal Bleeding

Lawrence R. Schiller, MD

Clinical Professor of Internal Medicine, University of Texas Southwestern Medical School; Director, Gastroenterology Fellowship Program, and Attending Physician, Digestive Health Associates of Texas, Baylor University Medical Center, Dallas, Texas

Diarrhea

Mitchell L. Schubert, MD

Professor of Medicine and Physiology, Virginia Commonwealth University Health System; Chief of Gastroenterology, McGuire Veterans Affairs Medical Center, Richmond, Virginia

Gastric Secretion

Joseph H. Sellin, MD

Professor of Medicine and Director, GI Fellowship Program, Baylor College of Medicine; Chief, Division of Gastroenterology, Ben Taub General Hospital, Houston, Texas

Diarrhea; Intestinal Electrolyte Absorption and Secretion

M. Gaith Semrin, MD, MBBS

Assistant Professor of Pediatric Gastroenterology, Hepatology, and Nutrition, University of Texas Southwestern Medical School; Attending Physician, University of Texas Southwestern Medical Center, Dallas, Texas

Anatomy, Histology, Embryology, and Developmental Anomalies of the Stomach and Duodenum

Vijay H. Shah, MD

Professor of Medicine and Physiology, Mayo Clinic College of Medicine, Rochester, Minnesota

Portal Hypertension and Gastrointestinal Bleeding

Fergus Shanahan, MD, FRCP(UK), FRCPI, FACP, FRCP(C)

Professor and Chair, Department of Medicine, University College Cork, National University of Ireland; Consultant Gastroenterologist, Cork University Hospital, Cork, Ireland

Enteric Microbiota and Small Intestinal Bacterial Overgrowth

Corey A. Siegel, MD

Assistant Professor, Dartmouth Medical School, Hanover; Director, IBD Center, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire

Crohn's Disease

Maria H. Sjogren, MD, MPH, FACP

Associate Professor of Medicine, Georgetown University School of Medicine, Washington, DC; Associate Professor of Preventive Medicine, Uniformed Services University of the Health Sciences F. Edward Hébert School of Medicine, Bethesda, Maryland; Staff Physician, Department of Gastroenterology/Hepatology, Walter Reed Army Medical Center, Washington, DC

Hepatitis A

Rhonda F. Souza, MD

Associate Professor of Medicine, University of Texas Southwestern Medical School; Staff Physician, Veterans Affairs North Texas Health Care System, Dallas, Texas

Barrett's Esophagus

Stuart Jon Spechler, MD

Professor of Medicine and Berta M. and Cecil O. Patterson Chair in Gastroenterology, University of Texas Southwestern Medical Center; Chief, Division of Gastroenterology, Veterans Affairs North Texas Health Care System, Dallas, Texas

Barrett's Esophagus

William M. Steinberg, MD

Clinical Professor of Medicine, George Washington University School of Medicine and Health Sciences, Washington, DC

Acute Pancreatitis

William E. Stevens, MD

Clinical Faculty, Department of Internal Medicine, Division of Gastroenterology, Presbyterian Hospital of Dallas, Dallas, Texas

Vascular Diseases of the Liver

Andrew H. Stockland, MD

Assistant Professor of Radiology, Mayo Clinic College of Medicine; Consultant, Diagnostic Radiology, Mayo Clinic, Rochester, Minnesota

Endoscopic and Radiologic Treatment of Biliary Disease

Neil H. Stollman, MD

Associate Clinical Professor of Medicine, Division of Gastroenterology, University of California, San Francisco, School of Medicine, San Francisco; Chief, Division of Gastroenterology, Alta Bates Summit Medical Center, Oakland, California

Diverticular Disease of the Colon

Frederick J. Suchy, MD

Professor and Chair, Department of Pediatrics, Mount Sinai School of Medicine; Pediatrician-in-Chief, Kravis Children's Hospital, New York, New York

Anatomy, Histology, Embryology, Developmental Anomalies, and Pediatric Disorders of the Biliary Tract

Jan Tack, MD, PhD

Professor of Medicine and Chair, Department of Pathophysiology, University of Leuven; Clinic Head, Division of Gastroenterology, University Hospital Leuven, Leuven Belgium

Dyspepsia

Nicholas J. Talley, MD, PhD

Professor of Medicine, Mayo Clinic College of Medicine; Division of Gastroenterology and Hepatology, Mayo Clinic, Jacksonville, Florida

Irritable Bowel Syndrome

Scott Tenner, MD, MPH

Associate Professor of Medicine, State University of New York Health Science Center at Brooklyn; Director, Medical Education and Research, Maimonides Medical Center, Brooklyn, New York

Acute Pancreatitis

Narci C. Teoh, MBBS, PhD, FRACP

Associate Professor of Medicine, Australian National University Medical School; Senior Staff Specialist in Gastroenterology and Hepatology, Canberra Hospital, Canberra, Australian Capital Territory, Australia

Liver Disease Caused by Drugs

Dwain L. Thiele, MD

Professor and Vice Chair, Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, Texas

Gastrointestinal and Hepatic Manifestations of Systemic Diseases

Richard H. Turnage, MD

Professor and Chair, Department of Surgery, University of Arkansas for Medical Sciences; UAMS Medical Center, Little Rock, Arkansas

Intestinal Obstruction

Sonal P. Ullman, MD

Gastroenterologist, Beth Israel Deaconess Hospital—Needham, Needham, Massachusetts

Constipation

Nimish Vakil, MD

Clinical Professor of Medicine, University of Wisconsin School of Medicine and Public Health, Madison; Gastroenterologist, Aurora Health Care, Waukesha, Wisconsin

Peptic Ulcer Disease

Jayashree Venkatasubramanian, PhD

Visiting Research Assistant Professor, Department of Physiology and Biophysics, University of Illinois College of Medicine at Chicago, Chicago, Illinois

Intestinal Electrolyte Absorption and Secretion

Axel von Herbay, MD

Professor and Consultant in Gastrointestinal Pathology, John Radcliffe Hospital, Oxford, United Kingdom

Whipple's Disease

Arnold Wald, MD

Professor of Medicine, Section of Gastroenterology and Hepatology, Department of Medicine, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin

Other Diseases of the Colon and Rectum

David Q.-H. Wang, MD, PhD

Assistant Professor of Medicine, Harvard Medical School; Gastroenterologist, Beth Israel Deaconess Medical Center, Boston, Massachusetts

Gallstone Disease

Timothy C. Wang, MD

Dorothy L. and Daniel Silberberg Professor of Medicine, Columbia University College of Physicians and Surgeons; Chief, Digestive and Liver Diseases, Columbia University Medical Center, New York, New York

Adenocarcinoma and Other Tumors of the Stomach

David C. Whitcomb, MD, PhD

Professor of Medicine, Cell Biology and Physiology, and Human Genetics, University of Pittsburgh School of Medicine, Pittsburgh; Chief, Division of Gastroenterology, Hepatology, and Nutrition, University of Pittsburgh Medical Center, Allison Park, Pennsylvania

Hereditary, Familial, and Genetic Disorders of the Pancreas and Pancreatic Disorders in Childhood

C. Mel Wilcox, MD

Professor of Medicine, University of Alabama School of Medicine at Birmingham; Division of Gastroenterology and Hepatology, UAB Hospital, Birmingham, Alabama

Gastrointestinal Consequences of Infection with Human Immunodeficiency Virus

Christopher G. Willett, MD

Leonard Prosnitz Professor of Radiation Oncology, Duke University School of Medicine; Chief, Department of Radiation Oncology, Duke University Hospital, Durham, North Carolina

Radiation Injury

Gavitt Woodard, BS

Research Coordinator, Stanford University School of Medicine, Stanford, California

Bariatric Surgery

Stephan G. Wyers, MD

Assistant Professor of Surgery, University of Chicago Pritzker School of Medicine; General Surgery, University of Chicago Medical Center, Chicago, Illinois

Surgical Peritonitis and Other Diseases of the Peritoneum, Mesentery, Omentum, and Diaphragm

Joseph C. Yarze, MD, FACP, FACC, FASGE, AGAF

Consultant, Gastroenterology Associates of Northern New York; Medical Director, GI Center, Glens Falls Hospital, Glens Falls, New York

Chronic Abdominal Pain

Foreword

It is a pleasure to write the foreword for the 9th edition of Sleisenger and Fordtran's *Gastrointestinal and Liver Disease: Pathophysiology/Diagnosis/Management*, the classic textbook that has maintained its leadership position and progressively enhanced its reputation as the "go-to" book in its field. The extraordinary effort required to create a textbook that comprehensively and authoritatively presents the state of knowledge in an arena as broad and ever-expanding as gastroenterology is a daunting task but one that has been achieved with distinction in this 9th edition. The excellence and reliability exhibited by this considerably revised and updated edition amply validates the lasting value of the series.

Almost 40 years ago, Drs. Marvin Sleisenger and John Fordtran gathered a group of highly respected, thoughtful, and clinically excellent gastroenterologists to create what became the first edition of *Gastrointestinal and Liver Disease*. The book was a success from the onset. Subsequent editions have continued to successfully portray the accelerating evolution of gastroenterology. Gastroenterologists, internists, surgeons, pathologists, residents, and students from diverse backgrounds have relied on *Gastrointestinal and Liver Disease* as a thoughtful, extensively referenced, and user-accessible textbook. The images are well chosen and superbly produced. Important landmarks are noted, evaluated, and placed into proper perspective.

The 9th edition is ably edited by Drs. Mark Feldman, Lawrence Friedman, and Lawrence Brandt—all three highly respected clinicians and educators. This monumental undertaking continues a grand tradition and succeeds in providing authoritative overviews of the status of gastroenterology in the early 21st century. The editors are to be applauded for their efforts. The creation of a textbook requires considerable judgment in defining the current state of the art for a diverse range of disorders and in selecting authors best qualified to evaluate and lead the field. The editors have chosen the authors well for the 9th edition, with an admixture of established leaders and younger colleagues who represent the next generation that will advance gastroenterology.

A textbook differs in important ways from a journal. In a textbook, the state of knowledge is presented at a given, and set, time. A line is drawn in the sand. A successful chapter in a textbook defines the state of knowledge regarding a subject, provides a clear definition of what is known,

outlines how the knowledge evolved, suggests what challenges may be ahead, and offers a framework of advice as to the most efficient and effective means of establishing the diagnosis and developing a plan for treatment. The goal is to provide a foundation and a guide that will serve us well in the varied situations we encounter in clinical practice.

There surely have been outstanding advances in gastroenterology to incorporate into the 9th edition. Notable examples are the further emergence of advanced diagnostic and therapeutic endoscopy, introduction of liver and intestinal transplantation, development of more precise diagnostic genetic and serologic tests, and game-changing results derived from the advent of minimally invasive surgery. New innovative and effective therapeutic agents have been developed. These days, drugs are increasingly designed to solve a specific identified problem. Increasingly, therapeutic agents provide the ability to modulate inflammation, inhibit fibrosis, and regulate the processes that lead to cell death.

In the 9th edition of *Gastrointestinal and Liver Disease*, we are provided a sturdy platform to aid us now and direct us toward the future. What lies ahead is likely to be exciting beyond our most ambitious speculations. Knowledge will continue to evolve. Innovative, often life-changing therapies will be discovered. New challenges will emerge that must be faced.

As time goes by, we all will undoubtedly rely even more on electronically transmitted information (including the online version of this textbook, in which the references will be updated regularly). The role for a comprehensive, respected medical textbook, however, is far from over. We salute those who wrote and those who edited *Gastrointestinal and Liver Disease*. Through their efforts we are provided with renewed confidence that tangible progress is being achieved on many fronts.

An effective textbook reminds us of the past, firmly grounds us in the present, and guides our expectations and hopes for the future. *Gastrointestinal and Liver Disease* is such a book. We, the readers and our patients, will benefit from the guide provided.

Willis C. Maddrey, MD

University of Texas Southwestern Medical Center
Dallas, Texas

Preface

The 9th edition of *Sleisenger and Fordtran's Gastrointestinal and Liver Disease* is the second edition for which the three of us have served together as editors and the first for which neither Dr. Fordtran nor Dr. Sleisenger has participated. We remain grateful to their inspiring examples as visionaries and superb editors and are pleased to present an edition that we believe is worthy of their high standards and commitment to excellence. This edition is the first for which a single purchase will provide all readers with both a copy of the book and access to the online version of the text; the latter will be updated regularly to keep readers abreast of new developments in the rapidly evolving field of gastroenterology and liver disease. Moreover, providing readers with online access has allowed us to reduce the bulk of the hard copy of the book by listing only 15 or so key references per chapter and referring the reader to the online version for the complete list of references cited in each chapter and linked to PubMed. We are confident that readers will appreciate the improved "portability" of the book.

Like its predecessors, the 9th edition presents a critical overview of the state of gastrointestinal practice and its scientific basis by eminent authorities in their respective fields. With authors from at least 12 countries on 4 continents, the book is truly international in scope. We have been aided in our preparation of the 9th edition by the valuable feedback provided by our colleagues, trainees, reviewers, and readers; this has led to incremental refinements and enhancements since the highly acclaimed 8th edition, which received the first prize for a textbook in Gastroenterology from The British Medical Association in 2007. Attributes of the book, we believe, are its logical organization, minimized redundancies, polished writing, incorporation of color figures into the body of the text, inclusion of clear, visually appealing algorithms to summarize clinical decision making, and practical approaches to patient management. As always, we have tried to incorporate new, high-quality scientific evidence as the basis of rational treatment, while alerting readers to emerging developments that hold promise for new approaches to patient management.

To keep the book fresh and to ensure critical review of fields for which controversy exists, we have again rotated the authorship of many chapters, with approximately one third of the authors being new to this edition. We feel particularly fortunate to have enlisted contributors who are renowned authorities in their fields. Each has been chosen for his or her expertise and skills in communication, and it was a remarkable privilege for us to work with such accomplished colleagues. Reflecting recent trends in the practice of gastroenterology, three new chapters have been added to the 9th edition. First, a chapter by Drs. Woodard and Morton is devoted to Bariatric Surgery and complements the chapter on Obesity by Dr. Bray. This new chapter is an indication of the emerging role of the gastroenterologist not only in the selection of patients for bariatric surgery but also in the management of postsurgical complications and eventually in the endoscopic management of obesity. Second, a chapter on Barrett's Esophagus by Drs. Spechler and Souza has been separated from the chapter on Gastroesophageal Reflux Disease by Drs. Richter and Freidenberg, again reflecting the

importance and controversies concerning the premalignant nature of Barrett's esophagus and emerging approaches to its treatment. Third, a new chapter on Endoscopic Treatment of Pancreatic Disease complements the chapter on Endoscopic and Radiologic Treatment of Biliary Disease, both by Dr. Baron, with two different co-authors (Drs. Ferreira and Stockland, respectively), and reflects the expanding role of endoscopic interventions in the management of pancreatic disorders. Additionally, two chapters in the 8th edition have been merged into a single chapter in the 9th edition—Foreign Bodies, Bezoars, and Caustic Injury, by Drs. Pfau and Ginsberg.

The organization of the 9th edition is otherwise similar to that of the 8th edition with the exception that the section on Nutrition in Gastroenterology (Section II) has now been placed, more logically we believe, before the section on Symptoms, Signs, and Biopsychosocial Issues (Section III). In Section I on Biology of the Gastrointestinal Tract, we are delighted to welcome Drs. Dotan and Mayer, who provide a comprehensive overview of Gastrointestinal Immunology and Inflammation. In Section III, we welcome Dr. Millham (Acute Abdominal Pain), Dr. Yarze (Chronic Abdominal Pain), Dr. Tack (Dyspepsia), Dr. Rao (Fecal Incontinence), and Drs. Savides and D. Jensen (Gastrointestinal Bleeding), all recognized experts in their respective fields. We are also happy to welcome back Dr. Drossman, who has provided a masterly discussion of Biopsychosocial Issues in Gastroenterology. Section IV deals with Topics Involving Multiple Organs and includes an expanded discussion of Eosinophilic Disorders of the Gastrointestinal Tract, with a section on eosinophilic esophagitis, by Drs. Khan and Orenstein, and an expanded chapter on Preparation for and Complications of Gastrointestinal Endoscopy by Dr. Kimmey. Among the many other noteworthy contributors in this section are Drs. Li and Collins (Gastrointestinal Lymphomas), Dr. Demetri (Gastrointestinal Stromal Tumors), Dr. Oberg (Carcinoid Tumors), Drs. R. Jensen and Norton (Pancreatic and Gastrointestinal Endocrine Tumors), Drs. Larson and McDonald (Gastrointestinal and Hepatic Complications of Solid Organ and Hematopoietic Cell Transplantation), and Drs. Willett and Czito (Radiation Injury).

The next six sections cover the Esophagus, Stomach and Duodenum, Pancreas, Biliary Tract, Liver, and Small and Large Intestine. Among the new authors are Drs. Kahrilas and Pandolfino (Esophageal Motor and Sensory Function and Motor Disorders), Drs. Kaunitz and Schubert (Gastric Secretion), Drs. Crowe and Peura (*Helicobacter pylori*), Dr. Vakil (Peptic Ulcer Disease), Drs. Wang and Afdhal (Gallstone Disease), Dr. Andersson (Acalculous Cholecystitis, Cholesterosis, Adenomyomatosis, and Gallbladder Polyps), Drs. Blechacz and Gores (Tumors of the Bile Ducts, Gallbladder, and Ampulla), Dr. Misraji (Anatomy, Histology, Embryology, and Developmental Anomalies of the Liver), Dr. Pratt (Liver Chemistry and Function Tests), Drs. O'Leary and Davis (Hepatitis C), Drs. Nevah and Fallon (Hepatic Encephalopathy, Hepatorenal Syndrome, Hepatopulmonary Syndrome, and Systemic Complications of Liver Disease), Drs. Belefer and Di Bisceglie (Hepatic Tumors and Cysts), Dr. Ramakrishna (Tropical Malabsorption and