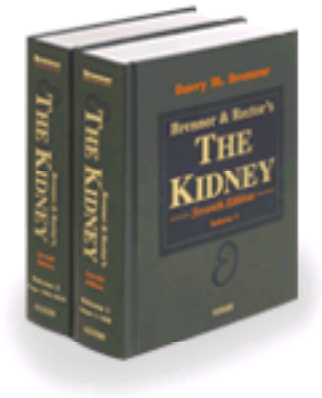

Benner & Rector's the Kidney 7th edition (November 14, 2003) by Barry M. Brenner (Editor), FL



By OkDoKeY

– **Frontmatter**

■ **Title Page**

■ **Copyright Page**

■ **Dedication**

■ **Contributors**

■ **Preface**

■ **Foreword**

+ **Section I - Elements of Normal Renal Structure and Function**

+ **Section II - Disturbances in Control of Body Fluid Volume**

+ **Section III - Pathogenesis of Renal Disease**

+ **Section IV - Pathophysiology of Renal Disease**

+ **Section V - Management of the Patient with Renal Failure**

– Section I - Elements of Normal Renal Structure and Function

- + 1 - Anatomy of the Kidney**
- + 2 - Developmental Biology of the Kidney**
- + 3 - Biology of Renal Cells in Culture**
- + 4 - Cell-Cell and Cell-Matrix Interactions in the Kidney**
- + 5 - The Metabolic Basis of Solute Transport**
- + 6 - The Molecular Basis of Solute Transport**
- + 7 - The Renal Circulations**
- + 8 - Glomerular Ultrafiltration**
- + 9 - Renal Transport of Glucose, Amino Acids, Sodium, Chloride, and Water**
- + 10 - Control of Renal Potassium Excretion**
- + 11 - Renal Acidification Mechanisms**
- + 12 - Renal Transport of Calcium, Magnesium, and Phosphate**
- + 13 - The Cell Biology of Vasopressin Action**
- + 14 - Urine Concentration and Dilution**
- + 15 - Renal Handling of Organic Anions and Cations: Excretion of Uric Acid**
- + 16 - Vasoactive Peptides and the Kidney**
- + 17 - Arachidonic Acid Metabolites and the Kidney**

– **Section II - Disturbances in Control of Body Fluid Volume**

+ 18 - Control of Extracellular Fluid Volume and the Pathophysiology of Edema Formation

+ 19 - Pathophysiology of Water Metabolism

+ 20 - Acid-Base Disorders

+ 21 - Disorders of Potassium Balance

+ 22 - Clinical Disturbances of Calcium, Magnesium, and Phosphate Metabolism

– Section III - Pathogenesis of Renal Disease

- + [23 - Approach to the Patient with Kidney Disease](#)
- + [24 - Laboratory Assessment of Kidney Disease: Clearance, Urinalysis, and Kidney Biopsy](#)
- + [25 - Interpretation of Urine Electrolyte and Acid-Base Parameters](#)
- + [26 - Radiologic Assessment of the Kidney](#)
- + [27 - Acute Renal Failure](#)
- + [28 - Primary Glomerular Disease](#)
- + [29 - Secondary Glomerular Disease](#)
- + [30 - Tubulointerstitial Diseases](#)
- + [31 - Urinary Tract Infection, Pyelonephritis, and Reflux Nephropathy](#)
- + [32 - Disorders of the Renal Arteries and Veins](#)
- + [33 - Microvascular Diseases of the Kidney](#)
- + [34 - Toxic Nephropathy](#)
- + [35 - The Kidney and Hypertension in Pregnancy](#)
- + [36 - Inherited Disorders of the Renal Tubule](#)
- + [37 - Cystic Diseases of the Kidney](#)
- + [38 - Diabetic Nephropathy](#)
- + [39 - Nephrolithiasis](#)
- + [40 - Urinary Tract Obstruction](#)
- + [41 - Renal Neoplasia](#)

– **Section IV - Pathophysiology of Renal Disease**

- + 42 - Renal and Systemic Manifestations of Glomerular Disease
- + 43 - Adaptation to Nephron Loss
- + 44 - Biology of the Vascular Wall in Hypertension
- + 45 - Essential Hypertension
- + 46 - Renovascular Hypertension and Ischemic Nephropathy
- + 47 - Hypertension and Renal Disease
- + 48 - Pathophysiology of Uremia
- + 49 - Hematologic Consequences of Renal Failure
- + 50 - Cardiovascular Aspects of Chronic Kidney Disease
- + 51 - Neurologic Complications of Renal Insufficiency
- + 52 - Renal Osteodystrophy
- + 53 - Effect of Aging on Renal Function and Disease

- Section V - Management of the Patient with Renal Failure

- + 54 - Diuretics**
- + 55 - Antihypertensive Drugs**
- + 56 - Specific Pharmacologic Approaches to Clinical Renoprotection**
- + 57 - Nutritional Therapy in Renal Disease**
- + 58 - Erythropoietin Therapy in Renal Disease and Renal Failure**
- + 59 - Hemodialysis**
- + 60 - Peritoneal Dialysis**
- + 61 - Intensive Care Nephrology**
- + 62 - Extracorporeal Treatment of Poisoning**
- + 63 - Transplantation Immunobiology**
- + 64 - Donor and Recipient Issues in Renal Transplantation**
- + 65 - Clinical Aspects of Renal Transplantation**
- + 66 - Prescribing Drugs in Renal Disease**

I

II

III

BRENNER & RECT **The Kidney**

Seventh Edition

Barry M. Brenner M.D., A.M. (Hon.), D.Sc. (Hon.), D.M.Sc. (Hon.), M.D. (Hon.), Dipl. (Hon.), F.R.C.P. (C)
Samuel A. Levine Professor of Medicine
Harvard Medical School
Director Emeritus,
Renal Division,
and Senior Physician,
Department of Medicine
Brigham and Women's Hospital
Boston, Massachusetts

SAUNDERS
An Imprint of Elsevier

IV

SAUNDERS

An Imprint of Elsevier

The Curtis Center
Independence Square West
Philadelphia, Pennsylvania 19106

Volume 1: Part no. 9997637097

Volume 2: Part no. 9997637100

Two-volume set ISBN 0-7216-0164-2

BRENNER & RECTOR'S THE KIDNEY

© 2004, 2000, 1996, 1991, 1986, 1981, 1976, Elsevier Inc. 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, and information storage and retrieval system, without permission in writing from the publisher.

Permissions may be sought directly from Elsevier's Health Sciences Rights Department in Philadelphia, PA, at healthpermissions@elsevier.com. You may also complete your request on-line via the Elsevier ScienceDirect website at <http://www.elsevier.com/locate/permissions>. Select "Obtaining Permissions" and then "Obtaining Permissions."

NOTICE

Nephrology is an ever-changing field. Standard safety precautions must be followed, but as new research and treatment and drug therapy may become necessary or appropriate. Readers are advised to check the package insert of each drug to be administered to verify the recommended dose, the method and duration of administration, and to consult the treating physician, relying on experience and knowledge of the patient, to determine dosages and administration. The publisher and editor assume no liability for any injury and/or damage to persons or property arising from the use of the information contained in this publication.

The Publisher

Library of Congress Cataloging-in-Publication Data

Brenner & Rector's the kidney / editor, Barry M. Brenner—7th ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-7216-0164-2

1. Kidneys—Diseases. 2. Kidneys. I. Title: Kidney. II. Brenner, Barry M. III. Rector, Floyd C.

RC902.K53 2004

616.6'1—dc21

2003042846

Acquisitions Editor: Susan Di...

*Jane and I
dedicate this edition
to our mothers
Beatrice and Sally
our children
Rob, Jen, and Ron
and our wonderful grandson Sam*

Contributors

Zaid A. Abassi Ph.D.

Senior Lecturer,
Faculty of Medicine,
Technion,
Israeli Institute of Technology;
Principal Investigator,
Laboratory of Vascular Biology and Renal Physiology,
Rambam Medical Center,
Haifa, Israel
Control of Extracellular Fluid Volume and the Pathophysiology of Edema Formation

Sharon Anderson M.D.

Professor of Medicine,
Oregon Health Sciences University School of Medicine,
Portland, Oregon
Renal and Systemic Manifestations of Glomerular Disease

Gerald B. Appel M.D.

Professor of Clinical Medicine,
Columbia University College of Physicians and Surgeons;
Director of Clinical Nephrology,
Presbyterian Hospital Division of the New York-Presbyterian Hospital,
New York, New York
Secondary Glomerular Disease

Raymond Ardaillou M.D.

Emeritus Professor of Physiology,
Faculty of Medicine,
University of Paris 6—Saint-Antoine,
Paris, France
Biology of Renal Cells in Culture

Professor and Chair,
Department of Medicine,
American University of Beirut;
Attending Physician,
American University of Beirut Medical Center,
Beirut, Lebanon
Microvascular Diseases of the Kidney

James L. Bailey M.D.

Professor of Medicine,
Emory University School of Medicine;
Attending Physician,
Grady Memorial Hospital and Emory University Hospital,
Atlanta, Georgia
Pathophysiology of Uremia

Matthew A. Bailey Ph.D.

Postdoctoral Fellow,
Department of Cellular and Molecular Physiology,
Yale University School of Medicine,
New Haven, Connecticut
Control of Renal Potassium Excretion

Laurent Baud M.D., Ph.D.

Professor of Physiology,
Faculty of Medicine,
University of Paris 6—Saint-Antoine;
Director,
Department of Physiology,
Hôpital Tenon,
Paris, France
Biology of Renal Cells in Culture

Michel Baum M.D.

Professor of Pediatrics and Internal Medicine,
Department of Pediatrics,
University of Texas Southwestern Medical Center at Dallas,
Dallas, Texas
Renal Transport of Glucose, Amino Acids, Sodium, Chloride, and Water

Bradford C. Berk M.D., Ph.D.

Faculty,
GEBS Cell Regulation and Molecular Pharmacology,
University of Rochester School of Medicine and Dentistry;
Physician-in-Chief,
Strong Memorial Hospital,
University of Rochester Medical Center,
Rochester, New York
Biology of the Vascular Wall in Hypertension

New York, New York
Essential Hypertension

Alain Bonnardeaux M.D., Ph.D.

Associate Professor of Medicine,
Université de Montréal;
Scientific Director,
Centre de Recherche Guy-Bernier,
Hôpital Maisonneuve-Rosemont,
Montréal, Québec, Canada
Inherited Disorders of the Renal Tubule

Hugh Redmond Brady M.D., Ph.D.

Professor of Medicine and Therapeutics,
Conway Institute of Biomolecular and Biomedical Research,
University College Dublin;
Attending Physician,
Mater Misericordiae University Hospital,
Dublin, Ireland
*Cell-Cell and Cell-Matrix Interactions;
Acute Renal Failure*

Barry M. Brenner M.D.

Samuel A. Levine Professor of Medicine,
Harvard Medical School;
Director Emeritus, Renal Division, and Senior Physician,
Department of Medicine,
Brigham and Women's Hospital,
Boston, Massachusetts
*The Renal Circulations;
Glomerular Ultrafiltration;
Renal and Systemic Manifestations of Glomerular Disease;
Adaptation to Nephron Loss*

Matthew D. Breyer M.D.

Division of Nephrology and Hypertension,
Vanderbilt University School of Medicine,
Nashville, Tennessee
Arachidonic Acid Metabolites and the Kidney

Michael E. Brier M.D.

Professor of Medicine,
University of Louisville School of Medicine;
Kidney Disease Program,
Division of Nephrology,
Department of Veterans Affairs,
Louisville, Kentucky
Prescribing Drugs in Renal Disease

Dennis Brown Ph.D.

Los Angeles, California
Hypertension and Renal Disease

Riccardo Candido M.D.

Physician,
Department of Medicine and Neurology,
University of Trieste,
Trieste, Italy
Vasoactive Peptides and the Kidney

Charles B. Carpenter M.D.

Professor of Medicine,
Harvard Medical School;
Senior Physician,
Laboratory of Immunogenetics and Transplantation,
Brigham and Women's Hospital,
Boston, Massachusetts
Transplantation Immunobiology

Anil Chandraker M.D.

Instructor of Medicine,
Harvard Medical School;
Director,
Renal Transplant Clinics,
Brigham and Women's Hospital,
Boston, Massachusetts
Transplantation Immunobiology

Ingrid J. Chang M.D.

Fellow,
Division of Nephrology,
Vanderbilt University Medical Center,
Nashville, Tennessee
Extracorporeal Treatment of Poisoning

Devasmita Choudhury M.D.

Associate Professor of Internal Medicine,
University of Texas Southwestern Medical Center at Dallas;
Director of Dialysis,
Dallas Veterans Affairs Medical Center,
Dallas, Texas
Effect of Aging on Renal Function and Disease

Michael R. Clarkson M.B.

Fellow in Nephrology,
Renal Division,
Brigham and Women's Hospital,
Boston, Massachusetts
Acute Renal Failure

Urinary Tract Infection, Pyelonephritis, and Reflux Nephropathy

John K. Crean Ph.D.

Lecturer,
University College Dublin,
Dublin, Ireland
Cell-Cell and Cell-Matrix Interactions

Pirouz Daeihagh M.D.

Assistant Professor,
Department of Internal Medicine and Nephrology,
Wake Forest University School of Medicine,
Winston-Salem, North Carolina
Peritoneal Dialysis

Vivette D. D'Agati M.D.

Professor of Pathology and Director,
Renal Pathology Laboratory,
Columbia University College of Physicians and Surgeons;
Attending Physician in Pathology,
Columbia Presbyterian Medical Center,
New York, New York
Secondary Glomerular Disease

Mogamat Razeen Davids M.D.

Associate Professor,
University of Stellenbosch,
Cape Town;
Senior Specialist,
Tygerberg Hospital,
Tygerberg, South Africa
Interpretation of Urine Electrolyte and Acid-Base Parameters

Paul E. de Jong M.D., Ph.D.

Professor of Nephrology,
University of Groningen;
Head,
Division of Nephrology,
University Hospital Groningen,
Groningen, The Netherlands
Specific Pharmacologic Approaches to Clinical Renoprotection

Dick de Zeeuw M.D., Ph.D.

Professor and Head,
Department of Clinical Pharmacology,
University Hospital Groningen,
Groningen, The Netherlands
Specific Pharmacologic Approaches to Clinical Renoprotection

Matthew Dollins M.D.

Murray J. Favus M.D.

Professor of Medicine,
University of Chicago Pritzker School of Medicine;
Director,
Bone Program,
University of Chicago Hospital,
Chicago, Illinois
Nephrolithiasis

Bernard V. Fishbach M.D.

Clinical Fellow,
Division of Nephrology,
Vanderbilt University Medical Center,
Nashville, Tennessee
Extracorporeal Treatment of Poisoning

Steven Fishbane M.D.

Associate Professor of Medicine,
State University of New York at Stony Brook School of Medicine,
Stony Brook;
Vice Chairman,
Department of Medicine,
Winthrop-University Hospital,
Mineola, New York
Erythropoietin Therapy in Renal Disease and Renal Failure

Gerard Friedlander M.D., Ph.D.

Professor of Physiology,
Faculty of Medicine of Xavier Bichat,
University of Paris 7;
Director,
Inserm Unit 426,
Paris, France
Biology of Renal Cells in Culture

Gerardo Gamba M.D., Ph.D.

Professor,
Biomedical Research Institute,
Faculty of Medicine,
National University of Mexico;
Department of Nephrology,
Instituto Nacional de Ciencias Mèdicas y Nutricion Salvador Zubiràn,
Instituto de Investigaciones Biomèdicas,
Mexico City, Mexico
Urine Concentration and Dilution

Daniel J. George M.D.

Associate Professor of Medicine,
Harvard Medical School;
Dana Farber Cancer Institute,

University of Toronto Faculty of Medicine;
Staff Nephrologist,
St. Michael's Hospital,
Toronto, Ontario, Canada
Interpretation of Urine Electrolyte and Acid-Base Parameters

*Deceased

x

L. Lee Hamm M.D.

Professor of Medicine and Chief,
Section of Nephrology and Hypertension,
Tulane University School of Medicine;
Vice Chairman,
Department of Medicine,
Tulane University Health Sciences Center,
New Orleans, Louisiana
Renal Acidification Mechanisms

Donna S. Hanes M.D.

Assistant Professor,
Division of Nephrology,
University of Maryland School of Medicine;
Attending Physician,
University of Maryland Hospital,
Baltimore, Maryland
Antihypertensive Drugs

Raymond C. Harris M.D.

Professor of Medicine and Director,
Division of Nephrology and Hypertension,
Vanderbilt University School of Medicine,
Nashville, Tennessee
Arachidonic Acid Metabolites and the Kidney

Matthias A. Hediger Ph.D.

Associate Professor,
Harvard Medical School;
Director,
Membrane Biology Program,
Renal Division,
Brigham and Women's Hospital,
Boston, Massachusetts
The Molecular Basis of Solute Transport

William L. Henrich M.D.

Professor of Medicine,
University of Maryland School of Medicine;
Chairman,

Physician,
Alfred Hospital,
Melbourne, Australia
Vasoactive Peptides and the Kidney

J. Charles Jennette M.D.

Professor and Chair,
Department of Pathology and Laboratory Medicine,
University of North Carolina at Chapel Hill School of Medicine,
Chapel Hill, North Carolina
Primary Glomerular Disease

Eric Jonasch M.D.

Assistant Professor of Medicine,
University of Texas—Houston Medical School;
Attending Physician,
M. D. Anderson Cancer Center,
Houston, Texas
Renal Neoplasia

Kamel S. Kamel M.D.

Assistant Professor of Medicine,
University of Toronto Faculty of Medicine;
Staff Nephrologist,
St. Michael's Hospital,
Toronto, Ontario, Canada
Interpretation of Urine Electrolyte and Acid-Base Parameters

Hussein H. Karnib M.D.

Senior Fellow,
Division of Nephrology,
Department of Internal Medicine,
American University of Beirut Medical Center,
Beirut, Lebanon
Microvascular Diseases of the Kidney

Bertram L. Kasiske M.D.

Professor,
University of Minnesota Medical School—Minneapolis;
Director,
Division of Nephrology,
Hennepin County Medical Center,
Minneapolis, Minnesota
Laboratory Assessment of Kidney Disease: Clearance, Urinalysis, and Kidney Biopsy

Carolyn J. Kelly M.D.

Professor of Medicine,
University of California,
San Diego,
School of Medicine,

Research Assistant Professor,
Division of Nephrology and Hypertension,
Oregon Health Sciences University School of Medicine,
Portland, Oregon;
Deputy Head,
Diabetes Center,
Institute of Clinical and Experimental Medicine,
Prague, Czech Republic
Renal and Systemic Manifestations of Glomerular Disease

Bruce C. Kone M.D.

Vice Chairman,
Department of Medicine,
and Director,
Division of Renal Diseases and Hypertension,
University of Texas—Houston Medical School;
Chief of Nephrology,
Memorial Hermann Hospital,
Houston, Texas
The Metabolic Basis of Solute Transport

Michael A. Kraus M.D.

Associate Professor of Clinical Medicine,
Division of Nephrology,
Indiana University School of Medicine University Hospital,
Indianapolis, Indiana
Intensive Care Nephrology

XI

John H. Laragh M.D.

Professor of Medicine,
Weill Medical College of Cornell University;
Attending Physician in Medicine,
New York-Presbyterian Hospital,
New York, New York
Essential Hypertension

Moshe Levi M.D.

Professor of Medicine, Physiology, and Biophysics and Head,
Division of Renal Diseases and Hypertension,
University of Colorado Health Sciences Center,
Denver, Colorado
Effect of Aging on Renal Function and Disease

Wilfred Lieberthal M.D.

Professor,
Department of Medicine,
Division of Nephrology

Instructor in Medicine,
Harvard Medical School;
Attending Physician,
Renal Division,
Brigham and Women's Hospital,
Boston, Massachusetts
Clinical Aspects of Renal Transplantation

Gerhard Malnic M.D.

Professor,
Department of Physiology and Biophysics,
Instituto de Ciências Biomédicas,
Universidade de São Paulo,
São Paulo, Brazil
Control of Renal Potassium Excretion

Kevin J. Martin M.B., B.Ch.

Professor of Medicine,
St. Louis University School of Medicine;
Director,
Division of Nephrology,
St. Louis University Hospital,
St. Louis, Missouri
Renal Osteodystrophy

Michael Mauer M.D.

Department of Pediatric Nephrology,
University of Minnesota Hospital and Clinic,
Minneapolis, Minnesota
Diabetic Nephropathy

Dianne B. McKay M.D.

Assistant Member,
Scripps Research Institute;
Director of Research,
Division of Nephrology,
Scripps Clinic,
La Jolla, California
Donor and Recipient Issues in Renal Transplantation

Lawrence P. McMahon M.D.

Senior Lecturer,
University of Melbourne;
Director,
Department of Nephrology,
Western Hospital,
Melbourne, Australia
Cardiovascular Aspects of Chronic Kidney Disease

Maya Meux M.D.

University of Texas Southwestern Medical Center at Dallas,
Dallas, Texas
Renal Transport of Glucose, Amino Acids, Sodium, Chloride, and Water

Bruce A. Molitoris M.D.

Professor of Medicine and Director,
Nephrology Division,
Indiana University School of Medicine,
Indianapolis, Indiana
Intensive Care Nephrology

David B. Mount M.D.

Assistant Professor of Medicine,
Harvard Medical School;
Attending Physician,
Renal Division,
Brigham and Women's Hospital,
Boston, Massachusetts
*The Molecular Basis of Solute Transport;
Disorders of Potassium Balance*

Patrick H. Nachman M.D.

Associate Professor of Medicine,
Division of Nephrology,
University of North Carolina at Chapel Hill School of Medicine,
Chapel Hill, North Carolina
Primary Glomerular Disease

Gerjan Navis M.D.

Professor of Experimental Nephrology and Renal Pharmacology,
University Hospital Groningen,
Groningen, The Netherlands
Specific Pharmacologic Approaches to Clinical Renoprotection

Eric G. Neilson M.D.

Hugh Jackson Morgan Professor of Medicine and Chair,
Department of Medicine,
Vanderbilt University School of Medicine;
Physician-in-Chief,
Vanderbilt University Hospital,
Vanderbilt University Medical Center,
Nashville, Tennessee
Tubulointerstitial Diseases

Soren Nielsen M.D., Ph.D.

Professor of Cell Biology and Pathophysiology,

Toxic Nephropathy

Patrick S. Parfrey M.D.

University Research Professor,
Health Sciences Center;
Staff Nephrologist and Director,
Patient Research Centre,
Health Care Corporation of St. John's,
St. John's, Newfoundland, Canada
Cardiovascular Aspects of Chronic Kidney Disease

Hans-Henrik Parving M.D.

Steno Diabetes Center,
Gentofte, Denmark
Diabetic Nephropathy

David L. Perkins M.D.

Associate Professor,
Harvard Medical School;
Laboratory of Molecular Immunology,
Department of Medicine,
Brigham and Women's Hospital,
Boston, Massachusetts
Transplantation Immunobiology

Georgi Pirtskhalaishvili M.D., Ph.D.

Fellow and AFUD Scholar,
Department of Urology,
University of Pittsburgh School of Medicine,
Pittsburgh, Pennsylvania
Urinary Tract Obstruction

Martin R. Pollak M.D.

Assistant Professor of Medicine,
Harvard Medical School;
Attending Physician,
Brigham and Women's Hospital,
Boston, Massachusetts
Clinical Disturbances of Calcium, Magnesium, and Phosphate Metabolism

Hamid Rabb M.D.

Associate Professor of Medicine,
Johns Hopkins University School of Medicine;
Physician Director,
Kidney Transplant Program,
Johns Hopkins Hospital,
Baltimore, Maryland
Cell-Cell and Cell-Matrix Interactions

Jai Radhakrishnan M.D.

Mario Negri Institute for Pharmacological Research,
Negri Bergamo Laboratories,
Division of Nephrology and Dialysis,
Bergamo, Italy
Hematologic Consequences of Renal Failure

Eberhard Ritz M.D.

Nephrology, Dialysis, and Transplantation,
Sektion Nephrologie,
Med. Universitätsklinik,
Heidelberg, Germany
Diabetic Nephropathy

Michael V. Rocco M.D.

Professor,
Internal Medicine and Nephrology,
Wake Forest University School of Medicine,
Winston-Salem, North Carolina
Peritoneal Dialysis

Andreas Rolfs Ph.D.

Department of Biochemistry and Molecular Pharmacology,
Harvard Medical School,
Boston;
Harvard Institute of Proteomics,
Cambridge, Massachusetts
The Molecular Basis of Solute Transport

Michael F. Romero Ph.D.

Associate Professor,
Department of Physiology and Biophysics,
Case Western Reserve University School of Medicine,
Cleveland, Ohio
The Molecular Basis of Solute Transport

Pierre Ronco M.D., Ph.D.

Professor of Renal Medicine,
Faculty of Medicine,
University of Paris 6—Saint-Antoine;
Director,
Department of Nephrology and Inserm Unit 489,
Hôpital Tenon,
Paris, France
Biology of Renal Cells in Culture

Robert H. Rubin M.D.

Professor of Medicine,
Harvard Medical School;
Associate Director,
Division of Infectious Diseases,

Vanderbilt University School of Medicine;
Director,
End-Stage Renal Disease Program,
Vanderbilt University Medical Center,
Nashville, Tennessee
Hemodialysis

Domenic A. Sica M.D.

Professor of Medicine,
Virginia Commonwealth University School of Medicine;
Chairman,
Section of Clinical Pharmacology and Hypertension,
Virginia Commonwealth University Health System,
Richmond, Virginia
Renal Handling of Organic Anions and Cations: Excretion of Uric Acid

Saba Silé M.D.

Fellow in Nephrology,
Vanderbilt University School of Medicine,
Nashville, Tennessee
Extracorporeal Treatment of Poisoning

John R. Silkensen M.D.

Assistant Professor,
University of Minnesota Medical School—Minneapolis;
Staff Nephrologist,
Division of Nephrology,
Hennepin County Medical Center,
Minneapolis, Minnesota
Laboratory Assessment of Kidney Disease: Clearance, Urinalysis, and Kidney Biopsy

Karl L. Skorecki M.D.

Professor,
Bruce Rappaport Faculty of Medicine,
Technion,
Israeli Institute of Technology;
Director,
Department of Nephrology and Molecular Medicine,
Rambam Medical Center,
Haifa, Israel
Control of Extracellular Fluid Volume and the Pathophysiology of Edema Formation

Eduardo Slatopolsky M.D.

Professor of Medicine and Joseph Friedman Professor of Renal Diseases in Medicine,
Washington University School of Medicine;
Attending Physician,
Barnes-Jewish Hospital,
St. Louis, Missouri
Renal Osteodystrophy

John C. Stivelman M.D.

sample content of Brenner and Rector's The Kidney

- [Home Land pdf, azw \(kindle\), epub](#)
- [download The Ice Storm](#)
- [La bÃ©tarde book](#)
- [read Fire in the Sky \(Seekers, Book\) pdf, azw \(kindle\)](#)

- <http://junkrobots.com/ebooks/Chrysler-s-Turbine-Car--The-Rise-and-Fall-of-Detroit-s-Coollest-Creation.pdf>
- <http://schrolf.de/books/The-Ice-Storm.pdf>
- <http://conexdx.com/library/The-Fourth-Crusade-1202-04--The-betrayal-of-Byzantium--Campaign--Volume-237-.pdf>
- <http://test.markblaustein.com/library/Fire-in-the-Sky--Seekers--Book-.pdf>