

Second Edition

NEUROLOGICAL SURGERY

Volume 6

A Comprehensive Reference
Guide to the
Diagnosis and Management of
Neurosurgical Problems

Edited by

JULIAN R. YOUMANS, M.D., Ph.D.

Professor, Department of Neurological Surgery,
School of Medicine, University of California
Davis, California

1982 W. B. SAUNDERS COMPANY

Philadelphia • London • Toronto • Mexico City • Sydney • Tokyo

W. B. Saunders Company: West Washington Square
Philadelphia, PA 19105

1 St. Anne's Road
Eastbourne, East Sussex BN 21 3UN, England

1 Goldthorne Avenue
Toronto, Ontario M8Z 5T9, Canada

Cedro 512
Mexico 4, D.F. Mexico

9 Waltham Street
Artarmon, N.S.W. 2064, Australia

Ichibancho, Central Bldg., 22-1
Chiyoda-ku, Tokyo 102, Japan

Library of Congress Cataloging in Publication Data

Youmans, Julian Ray, 1928—
Neurological surgery.

1. Nervous system—Surgery. I. Title.
[DNLM: 1. Neurosurgery. WL368 N4945]
RD593.Y68 1980 617'.48
ISBN 0-7216-9667-8 (v. 6) 80-21368

Volume 1 ISBN 0-7216-9662-7
Volume 2 ISBN 0-7216-9663-5
Volume 3 ISBN 0-7216-9664-3
Volume 4 ISBN 0-7216-9665-1
Volume 5 ISBN 0-7216-9666-X
Volume 6 ISBN 0-7216-9667-8
Six Volume Set ISBN 0-7216-9658-9

Neurological Surgery—Volume Six

© 1982 by W. B. Saunders Company. Copyright 1973 by W. B. Saunders Company. Copyright under the Uniform Copyright Convention. Simultaneously published in Canada. All rights reserved. This book is protected by copyright. No part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the publisher. Made in the United States of America. Press of W. B. Saunders Company. Library of Congress catalog card number 80-21368.

Contributors

MARSHALL B. ALLEN, JR., M.D., F.A.C.S.

Intracerebral and Intracerebellar Hemorrhage, Sympathectomy

Chairman of Department of Neurological Surgery, Medical College of Georgia. Chief of Neurological Surgery, Eugene Talmadge Memorial Hospital; Consultant, University Hospital and Veterans Administration Hospital, Augusta, Georgia; Dwight D. Eisenhower Army Medical Center, Fort Gordon, Georgia; and Central State Hospital, Milledgeville, Georgia.

CHARLES E. BRACKETT, M.D., F.A.C.S.

Pulmonary Care and Complications, Arachnoid Cysts, Subarachnoid Hemorrhage, Post-Traumatic Arachnoid Cysts, Cordotomy

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, University of Kansas Medical Center, College of Health Sciences and Hospital. Chief of Neurological Surgery Service, University of Kansas Medical Center; Attending Staff, Kansas City Veterans Administration Hospital, Kansas City, Missouri.

VERNE L. BRECHNER, M.D., F.A.C.A.

Conduction Anesthesia Techniques

Clinical Professor of Anesthesiology, School of Medicine, University of California at Los Angeles. Attending Staff in Anesthesiology, Center for Health Sciences, University of California at Los Angeles, Los Angeles, California; Medical Director, Centinela Pain Management Center, Inglewood, California.

FERNANDO CABIESES, M.D., Ph.D., F.A.C.S.

Parasitic and Fungal Infections

Professor of Neurological Surgery (Ret.), School of Medicine, Universidad de San Marcos. Chief, Neurological Surgery Unit, Peruvian Armed Forces, Anglo-American Hospital, and Hospital 2 de Mayo, Lima, Peru.

WILLIAM F. COLLINS, M.D., F.A.C.S.

Physiology of Pain

Harvey and Kate Cushing Professor of Surgery, Chief of Section of Neurological Surgery, Yale University School of Medicine. Neurological Surgeon-in-Chief, Yale-New Haven Medical Center, New Haven, Connecticut.

WILLIAM S. COXE, M.D., F.A.C.S.*Viral Encephalitis*

Professor of Neurological Surgery, Washington University School of Medicine. Assistant Neurological Surgeon, Barnes and Allied Hospitals; Attending Neurological Surgeon, St. Louis City Hospital; Consultant, Veterans Administration Hospital, St. Louis, Missouri.

BENJAMIN L. CRUE, JR., M.D.*Stereotaxic Mesencephalotomy, Trigeminal Tractotomy*

Clinical Professor of Surgery (Neurological Surgery), University of California, School of Medicine at Los Angeles, Los Angeles, California. Director, New Hope Pain Center, Alhambra Community Hospital, Alhambra, California.

RICHARD A. DE VAUL, M.D.*Pain Refractory to Therapy*

Associate Professor of Psychiatry, The University of Texas Medical School at Houston. Attending Staff, Hermann Hospital and Memorial Southwest Hospital, Houston, Texas.

ELDON L. FOLTZ, M.D., F.A.C.S.*Affective Disorders Involving Pain*

Professor of Neurological Surgery, School of Medicine, University of California at Irvine. Chief of Section of Neurological Surgery, University of California Medical Center, Irvine, California.

PHILIP L. GILDENBERG, M.D., Ph.D., F.A.C.S.*Pain Refractory to Therapy*

Professor of Neurological Surgery and Chief of Division of Neurological Surgery, University of Texas Medical School at Houston. Chief of Neurological Surgery, Hermann Hospital, Houston, Texas.

SIDNEY GOLDRING, M.D., F.A.C.S.*Epilepsy in Adults*

Professor of Neurological Surgery and Co-Head of Department of Neurology and Neurological Surgery, Washington University School of Medicine. Neurosurgeon-in-Chief, Barnes Hospital and St. Louis Children's Hospital, St. Louis, Missouri.

STANLEY J. GOODMAN, M.D., F.A.C.S.*Bacterial Infections*

Associate Clinical Professor of Neurological Surgery, University of California, School of Medicine at Los Angeles, Los Angeles, California. Attending Staff, South Bay Hospital; San Pedro Peninsula Community Hospital, San Pedro, California; Community Hospital of Gardena, Gardena, California; Kaiser Hospital, Harbor City, California; Wadsworth Veterans Administration Hospital, Los Angeles, California; Little Company of Mary Hospital and Harbor General Hospital, Torrance, California.

JOHN R. GREEN, M.D., F.A.C.S.*Epilepsy in Children*

Adjunct Professor of Surgery (Neurological Surgery), University of Arizona College of Medicine, Tucson, Arizona. Director, Barrow Neurological Institute of St. Joseph's Hospital and Medical Center, Phoenix, Arizona.

JULES HARDY, M.D., F.R.C.S.(C.), F.A.C.S.*Indications for and Results of Hypophysectomy, Transsphenoidal Hypophysectomy*

Professor of Neurological Surgery, Chairman of Division of Neurological Surgery, University of Montreal Faculty of Medicine. Neurosurgeon, Notre Dame Hospital and University of Montreal Hospital, Montreal, Quebec.

NELSON HENDLER, M.D.*Psychiatric Aspects of Pain*

Assistant Professor of Psychiatry, The Johns Hopkins University School of Medicine. Psychiatric Consultant, Chronic Pain Treatment Center, Johns Hopkins Hospital, Baltimore, Maryland; Clinical Director, Mensana Clinic, Stevenson, Maryland.

PETER J. JANNETTA, M.D.*Micro-Operative Decompression for Trigeminal Neuralgia, Cranial Rhizopathies*

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, University of Pittsburgh. Active Staff, Presbyterian-University Hospital and Children's Hospital of Pittsburgh; Senior Attending Neurological Surgeon, Montefiore Hospital; Senior Consultant, Veterans Administration Hospital, Pittsburgh, Pennsylvania.

ROBERT B. KING, M.D., F.A.C.S.*Cephalic Pain*

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, State University of New York, Upstate Medical Center College of Medicine, Syracuse, New York. Chief of Neurological Surgery, State University Hospital of Upstate Medical Center; Attending Neurological Surgeon, Crouse-Irving Memorial Hospital; Consultant, Neurological Surgery, Veterans Administration Hospital. Syracuse, New York.

CAROLE C. LA MOTTE, Ph.D.*Physiology of Pain*

Assistant Professor of Neuroanatomy and Neurological Surgery, Sections of Neuroanatomy and Neurological Surgery, Yale University School of Medicine, New Haven, Connecticut.

HUN JAE LEE, M.D.*Parasitic and Fungal Infections*

Late Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, Yonsei University College of Medicine. Late Chief of Neurological Surgery, Yonsei Medical Center, Seoul, Korea.

JOHN D. LOESER, M.D.*Dorsal Rhizotomy*

Professor of Neurological Surgery, University of Washington School of Medicine. Attending Physician, University Hospital, Veterans Administration Hospital, Harborview Medical Center, and Children's Orthopedic Hospital, Seattle, Washington.

DONLIN M. LONG, M.D., Ph.D., F.A.C.S.*Tumors of Skull, Chronic Pain, Pain of Spinal Origin, Pain of Visceral Origin, Peripheral Nerve Pain*

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, The Johns Hopkins School of Medicine. Neurological Surgeon-in-Chief, Johns Hopkins Hospital, Baltimore, Maryland.

JOSE GERARDO MARTIN-RODRIGUES, M.D.*Tuberculoma and Syphilitic Gumma*

Head of Neurosurgical Service, Department "Sixto Obrador," Centro Especial "RAMON Y CAJAL," Ministry of Health and Social Security, Madrid, Spain.

WILLIAM H. MORETZ, M.D., F.A.C.S.*Sympathectomy*

President, Medical College of Georgia; Professor of Surgery, Medical College of Georgia. Attending Surgeon, Eugene Talmdge Memorial Hospital and University Hospital, Augusta, Georgia.

BLAINE SANDERS NASHOLD, JR., M.D., F.A.C.S.*Stereotaxic Mesencephalotomy, Trigeminal Tractotomy*

Professor of Neurological Surgery, Duke University School of Medicine. Attending Neurological Surgeon, Duke University Hospital, Durham, North Carolina.

SIXTO OBRADOR, M.D.*Tuberculoma and Syphilitic Gumma*

Late Professor of Neurological Surgery, Facultad de Medicina, Universidad Autonoma. Late Director and Chief of Department of Neurological Surgery, Centro Especial "RAMON Y CAJAL" of the Spanish Social Security, Madrid, Spain.

GEORGE A. OJEMANN, M.D.*Abnormal Movement Disorders*

Professor of Neurological Surgery, University of Washington School of Medicine. Attending Physician, University Hospital and Harborview Medical Center; Consultant, Veterans Administration Hospital, Seattle, Washington.

RUSSELL H. PATTERSON, JR., M.D., F.A.C.S.

Extradural Dorsal Spinal Lesions, Metastatic Brain Tumors, Hypophysectomy by Craniotomy

Professor of Neurological Surgery, Cornell University Medical College. Attending Surgeon-in-Charge, Department of Neurological Surgery, The New York Hospital, New York, New York.

ROBERT A. RATCHESON, M.D., F.A.C.S.

Stereotaxic Surgery

Harvey Huntington Brown, Jr., Professor of Neurological Surgery; Director of Division of Neurological Surgery, Case Western Reserve University School of Medicine. Director of Division of Neurological Surgery, University Hospitals of Cleveland, Cleveland, Ohio.

HUBERT L. ROSOMOFF, M.D., D. Med. Sc., F.A.C.S.

Stereotaxic Cordotomy

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, University of Miami School of Medicine. Chief of Neurosurgical Service, Jackson Memorial Hospital; Attending Neurological Surgeon, Veterans Administration Hospital; Medical Director, Pain and Back Rehabilitation Program, University of Miami Hospital and Diagnostic Clinic, Miami, Florida.

FRANK A. ROWE, M.D.

Parasitic and Fungal Infections

Resident, Neurological Surgery, University of California at Davis Medical Center at Sacramento, Sacramento, California.

HOWARD A. RUSK, M.D., F.A.C.P.

Rehabilitation

Distinguished University Professor, New York University. Founder, Institute of Rehabilitation Medicine, New York, New York.

GEORGE HEINRICH SELL, M.D.

Rehabilitation

Late Associate Professor of Clinical Rehabilitation Medicine, New York University School of Medicine. Late Acting Clinical Director, Institute of Rehabilitation Medicine, New York University Medical Center; Late Associate Attending Physician, Bellevue Medical Center, New York, New York.

ALVIN D. SIDELL, M.D.

Epilepsy in Children

Senior Pediatric Neurologist, Director of Electroencephalography Laboratory, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, Phoenix, Arizona.

W. EUGENE STERN, M.D., F.A.C.S.

Preoperative Evaluation, Prevention and Treatment of Complications; Bacterial Infections

Professor of Surgery/Neurological Surgery, University of California, School of Medicine at Los Angeles, Los Angeles, California. Chief of Neurological Surgery, University of California Los Angeles Center for Health Sciences; Neurological Surgeon Consultant, Wadsworth Veterans Administration Hospital, Harbor General Hospital, St. John's Hospital, Los Angeles, California, and Santa Monica Hospital, Santa Monica, California.

WILLIAM H. SWEET, M.D., D.Sc., D.H.C., F.A.C.S.

Intracerebral Stimulation for Pain, Primary Affective Disorders

Emeritus Professor of Surgery, Harvard Medical School. Senior Neurosurgeon, Massachusetts General Hospital; Consulting Neurosurgeon, New England Deaconess Hospital, Massachusetts Eye and Ear Infirmary, Waltham Hospital, and Milton Hospital, Boston, Massachusetts.

JOHN M. TEW, JR., M.D., F.A.C.S.

Percutaneous Rhizotomy for Trigeminal, Glossopharyngeal and Vagal Pain

Adjunct Professor of Anatomy, University of Cincinnati College of Medicine. Chairman of Department of Neurological Surgery, Good Samaritan Hospital; Attending Neurological Surgeon, Christ Hospital, Cincinnati, Ohio.

JOHN S. TYTUS, M.D., F.A.C.S.

Medical Therapy, Minor Procedures, and Craniotomy for Trigeminal Neuralgia; Glossopharyngeal and Geniculate Neuralgias

Clinical Associate Professor of Neurological Surgery, University of Washington School of Medicine. Attending Neurological Surgeon, Virginia Mason Hospital, King County Hospital, and Children's Orthopedic Hospital, Seattle, Washington.

JOHN M. VAN BUREN, M.D., Ph.D.

Stereotaxic Surgery

Professor of Neurological Surgery, University of Miami School of Medicine. Chief of Neurological Surgery, Veterans Administration Hospital; Attending Neurological Surgeon, Jackson Memorial Hospital, Miami, Florida.

ARTHUR A. WARD, JR., M.D.

Abnormal Movement Disorders

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, University of Washington School of Medicine. Attending Neurological Surgeon, University Hospital, Harborview Medical Center; Consultant, Veterans Administration Hospital, Children's Orthopedic Hospital, Seattle, Washington.

PHILIP RALPH WEINSTEIN, M.D., F.A.C.S.

Indications for and Results of Hypophysectomy, Stereotaxic Hypophysectomy

Professor of Neurological Surgery, University of Arizona School of Medicine. Chief

of Neurological Surgery, University of Arizona Hospital; Attending Neurological Surgeon, Tucson Medical Center; Consultant, Barrow Neurological Institute, St. Joseph's Hospital, Tucson, Arizona.

KEASLEY WELCH, M.D., M.S., F.A.C.S.

Sensory Root Section for Trigeminal Neuralgia

Franc D. Ingraham Professor of Neurosurgery, Harvard Medical School, Neurosurgeon-in-Chief, Children's Hospital Medical Center; Division Chief (Neurosurgery), Department of Surgery, Peter Bent Brigham Hospital and Women's Hospital, Boston, Massachusetts.

LOWELL E. WHITE, JR., M.D.

Affective Disorders Involving Pain

Professor of Neuroscience, University of South Alabama. Attending Neurological Surgeon, University of South Alabama Medical Center, Providence Hospital, Mobile, Alabama.

CHARLES B. WILSON, M.D., F.A.C.S.

Dural Fistulae, Chemotherapy, Sellar and Parasellar Tumors, Indications for and Results of Hypophysectomy, Stereotaxic Hypophysectomy

Professor of Neurological Surgery, Chairman of Department of Neurological Surgery, University of California. School of Medicine at San Francisco. Chief of Neurological Surgery, University Hospital, San Francisco, California.

R. LEWIS WRIGHT, M.D., F.A.C.S.

Infections of Spine

Attending Neurological Surgeon, St. Mary's Hospital and Stuart Circle Hospital, Richmond, Virginia.

JULIAN R. YOUMANS, M.D., Ph.D., F.A.C.S.

Diagnostic Biopsy, Cerebral Death, Cerebral Blood Flow, Trauma to Carotid Arteries, Glial and Neuronal Tumors, Lymphomas, Sarcomas and Vascular Tumors, Tumors of Disordered Embryogenesis, Peripheral and Sympathetic Nerve Tumors, Parasitic and Fungal Infections.

Professor of Neurological Surgery, University of California, School of Medicine at Davis, Davis, California. Attending Neurological Surgeon, University of California Davis Medical Center at Sacramento, Sacramento, California; Consultant in Neurological Surgery, United States Air Force Medical Center, Travis Air Force Base, California; Veterans Administration Hospital, Martinez, California.

RONALD F. YOUNG, M.D.

Cephalic Pain

Associate Professor of Neurological Surgery, University of California, School of Medicine at Los Angeles. Chief of Division of Neurological Surgery, Harbor General Hospital, Torrance, California; Attending Neurological Surgeon, University of California Hospital, Los Angeles, California.

Contents

VOLUME SIX

XI. Infections.....	3321
Chapter 110	
CRANIAL AND INTRACRANIAL BACTERIAL INFECTIONS.....	3323
<i>S. J. Goodman and W. E. Stern</i>	
Chapter 111	
VIRAL ENCEPHALITIS.....	3358
<i>W. S. Cox</i>	
Chapter 112	
PARASITIC AND FUNGAL DISEASES OF THE CENTRAL NERVOUS SYSTEM.....	3366
<i>F. A. Rowe, J. R. Youmans, H. J. Lee, and F. Cabieses</i>	
Chapter 113	
TUBERCULOMA AND SYPHILITIC GUMMA.....	3441
<i>S. Obrador and J. G. Martin-Rodriguez</i>	
Chapter 114	
INFECTIONS OF THE SPINE AND SPINAL CORD.....	3449
<i>R. L. Wright</i>	
 XII. Pain.....	 3459
Chapter 115	
PHYSIOLOGICAL ANATOMY OF PAIN.....	3461
<i>C. C. LaMotte and W. F. Collins</i>	
Chapter 116	
PSYCHIATRIC CONSIDERATIONS OF PAIN.....	3480
<i>N. Hendler</i>	
Chapter 117	
GENERAL CONSIDERATIONS IN THE MANAGEMENT OF CHRONIC PAIN.....	3523
<i>D. M. Long</i>	

Chapter 118	
CEPHALIC PAIN.....	3531
<i>R. B. King and R. F. Young</i>	
Chapter 119	
GENERAL CONSIDERATIONS, MEDICAL THERAPY, AND MINOR OPERATIVE PROCEDURES FOR TRIGEMINAL NEURALGIA.....	3554
<i>J. S. Tytus</i>	
Chapter 120	
TREATMENT OF TRIGEMINAL NEURALGIA BY PERCUTANEOUS RHIZOTOMY.....	3564
<i>J. M. Tew, Jr.</i>	
Chapter 121	
TREATMENT OF TRIGEMINAL NEURALGIA THROUGH TEMPORAL CRANIOTOMY.....	3580
<i>J. S. Tytus</i>	
Chapter 122	
TREATMENT OF TRIGEMINAL NEURALGIA BY SECTION OF THE SENSORY ROOT IN THE POSTERIOR FOSSA.....	3586
<i>K. Welch</i>	
Chapter 123	
TREATMENT OF TRIGEMINAL NEURALGIA BY MICRO-OPERATIVE DECOMPRESSION.....	3589
<i>P. J. Jannetta</i>	
Chapter 124	
GLOSSOPHARYNGEAL AND GENICULATE NEURALGIAS.....	3604
<i>J. S. Tytus</i>	
Chapter 125	
TREATMENT OF PAIN OF GLOSSOPHARYNGEAL AND VAGUS NERVES BY PERCUTANEOUS RHIZOTOMY.....	3609
<i>J. M. Tew, Jr.</i>	
Chapter 126	
PAIN OF SPINAL ORIGIN.....	3613
<i>D. M. Long</i>	
Chapter 127	
PAIN OF VISCERAL ORIGIN.....	3627
<i>D. M. Long</i>	
Chapter 128	
PAIN OF PERIPHERAL NERVE INJURY.....	3634
<i>D. M. Long</i>	
Chapter 129	
MANAGEMENT OF PAIN BY CONDUCTION ANESTHESIA TECHNIQUES.....	3644
<i>V. L. Brechner</i>	

Chapter 130	
DORSAL RHIZOTOMY.....	3664
<i>J. D. Loeser</i>	
Chapter 131	
STEREOTAXIC CORDOTOMY.....	3672
<i>H. L. Rosomoff</i>	
Chapter 132	
CORDOTOMY BY OPEN OPERATIVE TECHNIQUES.....	3686
<i>C. E. Brackett</i>	
Chapter 133	
STEREOTAXIC MESENCEPHALOTOMY AND TRIGEMINAL TRACTOTOMY.....	3702
<i>B. S. Nashold, Jr., and B. L. Crue, Jr.</i>	
Chapter 134	
SYMPATHECTOMY.....	3717
<i>M. B. Allen, Jr., and W. H. Moretz</i>	
Chapter 135	
AFFECTIVE DISORDERS INVOLVING PAIN.....	3727
<i>E. L. Foltz and L. E. White, Jr.</i>	
Chapter 136	
INTRACEREBRAL ELECTRICAL STIMULATION FOR THE RELIEF OF CHRONIC PAIN.....	3739
<i>W. H. Sweet</i>	
Chapter 137	
MANAGEMENT OF CHRONIC PAIN REFRACTORY TO SPECIFIC THERAPY.....	3749
<i>P. L. Gildenberg and R. A. DeVaul</i>	
XIII. Neurophysiological and Ablative Procedures.....	3769
Chapter 138	
CRANIAL RHIZOPATHIES.....	3771
<i>P. J. Jannetta</i>	
Chapter 139	
PRINCIPLES OF STEREOTAXIC SURGERY.....	3785
<i>J. M. Van Buren and R. A. Ratcheson</i>	
Chapter 140	
ABNORMAL MOVEMENT DISORDERS.....	3821
<i>G. A. Ojemann and A. A. Ward, Jr.</i>	
Chapter 141	
NEUROSURGICAL ASPECTS OF EPILEPSY IN CHILDREN AND ADOLESCENTS	3858
<i>J. R. Green and A. D. Sidell</i>	

Chapter 142	
NEUROSURGICAL ASPECTS OF EPILEPSY IN ADULTS.....	3910
<i>S. Goldring</i>	
Chapter 143	
NEUROSURGICAL ASPECTS OF PRIMARY AFFECTIVE DISORDERS....	3927
<i>W. H. Sweet</i>	
Chapter 144	
INDICATIONS FOR AND RESULTS OF HYPOPHYSECTOMY.....	3947
<i>J. Hardy, P. R. Weinstein, and C. B. Wilson</i>	
Chapter 145	
TRANSSPHEOIDAL HYPOPHYSECTOMY.....	3959
<i>J. Hardy</i>	
Chapter 146	
STEREOTAXIC HYPOPHYSECTOMY.....	3973
<i>P. R. Weinstein and C. B. Wilson</i>	
Chapter 147	
HYPOPHYSECTOMY BY CRANIOTOMY.....	3981
<i>R. H. Patterson, Jr.</i>	
XIV. Rehabilitation.....	3987
Chapter 148	
REHABILITATION FOLLOWING CENTRAL NERVOUS SYSTEM	
LESIONS.....	3989
<i>G. H. Sell and H. A. Rusk</i>	
INDEX	i

XI

INFECTIONS

CRANIAL AND INTRACRANIAL BACTERIAL INFECTIONS

BASIC CONSIDERATIONS

Despite the near elimination of several infectious diseases and the lowered morbidity and mortality rates for many others, infections continue to be an inherent part of human life. While certain specific microbial infections have been controlled, different ones are emerging as troublesome therapeutic and epidemiological problems. With the use of cytotoxic drugs, massive x-ray irradiation to treat malignant diseases, and immunosuppressive agents, infections caused by organisms previously considered saprophytic or commensal have increased. Moreover, although antimicrobial agents are successfully reducing the number of deaths associated with some common infections, other microbes are evolving into major causes of human disease.

To achieve an understanding of diagnostic procedures and therapeutic principles, general aspects of the host-organism relation must be studied, even though some of this information may not be specifically applicable to the individual patient who has an infection. *Bacteria*, *infection*, and *clinical disease* are not synonymous. Bacteria have been cultured from "clean" wounds at the time of operation. Growth of bacteria from clean wounds has no positive correlation with postoperative wound infection or the type of pathogens isolated from a subsequent infection.¹ Indeed, the multiplication of microorganisms within the host at normally sterile sites does not necessarily produce symptoms. In this case the host-orga-

nism relation is characterized as a "subclinical infection" or a "carrier state." The ratio of subclinical infection to overt clinical disease varies widely among microbial species.⁶

Host Factors: Resistance and Susceptibility

A group of host factors, collectively referred to as "resistance," or conversely, "susceptibility," influence the likelihood of disease and the outcome of infection once it is established. Hypothetically, the following metabolic and cellular factors are important in determining resistance: phagocytic function; the antibacterial activity of such substances as lysozymes, phagocytin, and other lysozomal enzymes; qualitative and quantitative alterations in serum proteins; disordered metabolism at the cellular level; the presence or absence of tissue-injury products influencing vascular permeability; the effects of tissue pressure; and similar processes. In experimental animals many factors can be shown to influence infection, e.g., sex, age, microbial strain, route of infection, the presence of specific antibodies or other diseases, the state of nutrition, exposure to ionizing radiation, high environmental temperature, the administration of certain compounds (such as mucin, nitrogen mustard, adrenal steroids, epinephrine and other vasopressors, and metabolic analogues), and xerosis. Many of these experimental variables are critically