

# CARDIAC PACING

A Concise Guide to Clinical Practice

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# CARDIAC PACING

A Concise Guide to Clinical Practice

*To all pioneering cardiologists, surgeons, and  
biomedical engineers who have made significant  
contributions to the field of cardiac pacing*

# Preface

Steady and at times spectacular advances in the development of new and more reliable pacemaker power sources, circuits, and electrodes have led to the introduction of a wide variety of sophisticated and specialized pacemaker devices. Concomitant rapid expansion has occurred in the indications for cardiac pacing, techniques for pacing, hemodynamic benefits, and longevity of the implantable pacemaker system.

Recent pacemaker statistics attest to the pervasive import of electrical pacing and its widespread application to patient management as an incisive therapeutic modality. Approximately 400,000 people throughout the world are living with a pacemaker, and of these, over 150,000 live in the United States. The United States has the highest rate of new pacemaker implants in the world—approximately 60,000 each year.

This book is a compilation of the science, major developments, and current clinical applications of cardiac pacing. It describes

the present state of the art and is intended for the needs of those who require a useful, authoritative and fundamental reference source. This book is designed to be comprehensive, concise, but not extensively detailed. It is a teaching document created by clinicians and teachers and written to present the wide scope of cardiac pacing to resident house officers, internists, surgeons, nurses, and bioengineers.

The editors have gathered together talented contributors who are prominent, active, and expert in the technology and practice of cardiac pacing. The underlying theme of this book underscores the fundamental electrophysiologic concepts of pacing, the role of pacing in the management of patients with cardiac dysrhythmias, and the methods and techniques that ensure the integrity and long-term success of the implantable pacemaker system.

Clinical principles and guidelines are stressed; established facts are emphasized

and controversial issues are minimized. The reader seeking quick references to varied pacemaker concepts, problems, and solutions will find valuable source material with a minimum of difficulty. Selected current references presenting original and authoritative research and clinical experiences in cardiac pacing are included at the conclusion of each chapter.

To make the discussions of the various subjects complete in themselves, a certain amount of repetition has been unavoidable—and desirable. It is hoped that this has been held to a minimum.

The editors are particularly fortunate for the cooperation received in the preparation of this book. To the contributors who have so generously given of their time, the editors are most gratefully indebted.

The editors are grateful to Dr. Angelo Taranta, Director of Medicine, and Dr. Raymond D. LaRaja, Director of Surgery, at the Cabrini Medical Center of New York for their valuable assistance and encouragement in the preparation of this book. Our gratitude is extended to Dennis Hepp, Medtronic engineer, and Richard O. Martin, Ph. D., Intermedics engineer, for their advice relative to bioengineering concepts

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We also acknowledge the kindness and support of Sr. Josephine Tsuei, M.S.C., President, and Mr. John Reilly, Executive Vice President, of Cabrini Medical Center of New York.

To our publishers, Lea & Febiger, we are indebted for their moral support and sympathetic understanding; to Mr. Ken Bussy, Executive Editor, for his constant help and valuable suggestions; to Miss Isabelle Clouser, copy editor, for her painstaking care and diligent review of the manuscript, and to Mr. Thomas Colaiezzi and Mr. Samuel Rondinelli, other staff members who made early publication of this book possible.

Finally, to our wives—Eileen Varriale and Gloria Naclerio—and to our children—Donna, Philip, and David Varriale and Emil Jr. and Ronald Naclerio—we wish to express our sincerest gratitude for their patience, understanding, and cooperation during the preparation of this book.

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# 1

## Cardiac Pacing in Perspective

DAVID CHAS. SCHECHTER

There is, in truth, no such thing as a method of discovery. It may come to one man after immense systematic analysis, to another by analogy, to a third as a sudden thought or vision, to yet another even as a dream, and in a hundred other ways. There is a method (or methods) of scientific demonstration, but that is a different thing from discovery. It is demonstration that is the basis of science.

—Professor Charles Singer, 1960

A purist might, with some justification, date the advent of cardiac pacing to 50 years ago, when Hyman designed an apparatus (later named “artificial pacemaker” by him) for the specific purpose of delivering electrical impulses at a physiologic rate to the heart in standstill. Doing so and then chronicling subsequent happenings in temporal order would, however, provide too simplistic and narrow an introduction to the background of what has become the dominant preoccupation of cardiac electrophysiology.

Cardiac pacing did not culminate from a natural and orderly procession of research enterprises aimed primarily at treating heart block. These came about, in fact, almost as an afterthought, whereas pacing eventuated from the conjunction of somewhat superficially interrelated clinical trials with electricity and laboratory inquiries on the

anatomic and physiologic bases of cardiac activity. For the sake of historical propriety, therefore, it is advisable to examine the evolution of cardiac pacing methodology and technology in broader perspective than that alluded to above, especially owing to latter-day diversification of pacing beyond the curtilage of the management of Morgagni-Adams-Stokes syndrome.

Parts of the narrative which follows will illustrate that, as is true of history in general, and maybe of medical history in particular, seldom can a distinguishable causality pattern be traced in the unfolding of major contributions to progress. The ledger shows that for every advance born by dint of prescience, persuasiveness, ratiocination, above-average working facilities, or just plain hard labor there has been a multitude of missed opportunities, mistaken notions, obdurate opposition, or steps backtracked