FOREWORD

Just two decades ago, a 35 mm–camera-based, three-dimensional motion measurement system was being used to evaluate a spinal construct stabilized with Harrington rods. At the same time, two revolutionary spine implants emerged, each exemplifying a completely different philosophy, with design and use in clinical practice for the treatment of degenerative disc disease: the internal fixator of W. Dick and the Charité total disc prosthesis of K. Büttner-Janz and K. Schellnack. We could not have imagined that over the years the spine surgery paradigm would shift from fusion, a long-time gold standard of care, to motion preservation. This shift has only become possible as a result of effective collaboration between engineers and surgeons, both approaching the problem from different angles.

Fusion technology with cages, bone substitutes, and further developments of transpedicular systems and minimally invasive techniques was becoming more sophisticated, yet the clinical results did not necessarily meet the expectations of either the surgeon or the patient. The reputation of fusion technology decreased as spine surgeons became aware of the adverse consequences of fusion such as stiffness, loss of mobility, junctional degeneration, and "fusion disease." Where could we go?

One of the early chapters of this book opens with this statement: "Disc devices have emerged from biomechanical laboratories and small pilot studies as potentially useful in the clinical setting." This typifies the main theme of the book: to address the science behind the development of motion preservation technologies and their clinical applications. The book's contributors include both surgeon scientists and engineering scientists—a great strength, and representative of what is required these days for significant advances: the marriage of basic science and clinical disciplines.

Nonfusion Techniques for the Spine: Motion Preservation and Balance presents a state-of-the-art treatise, pro and con, on the spectrum of issues of nonfusion motion preservation systems. At present the motion preservation devices that are being researched, pursued by industry, and finally being scrutinized by the surgical community are artificial discs for the cervical and lumbar regions, vertebroplasty-type reconstructions for the thoracic region, nucleus replacements, posterior stabilization systems, and more recently, devices that help seal anular tears. The reason for this is that the evolution toward resolving the problems in fusion technology by more physiologic means has been to provide controlled motion of the anterior and posterior columns of the symptomatic degenerative interspace. In addi-

tion, the natural desire of humans to simulate the behavior of nature, such as occurs with arthroplasty of the extremities, has led to exciting motion-preserving techniques that can be accomplished in novel ways. Nucleus replacement, total disc replacement, and segmental posterior and pedicle-based dynamic implants are representative of this class.

Nonfusion Techniques for the Spine succeeds in providing a scientific debate both for and against fusion and motion preservation technologies. We congratulate Drs. Maxwell, Griffith, and Welch, who themselves are accomplished researchers and practitioners in the field of spine, for hand-picking the very best blend of bioengineers and surgeons as contributors. Every author has taken time to share his beliefs, buttressed by scientific rationale. This book will stimulate the minds of readers for further research and assist surgeons in reaching an informed decision in applying technology to the patient. Moreover, the contents of this book provide both young and experienced surgeons with the education basis for gaining a greater understanding of this most significant shift toward motion in spinal reconstruction. We hope, just as total hip replacement has replaced hip fusion, that spinal arthroplasty and its variants will have the expected significant impact for the spine patient.

This text should find a welcome place on everyone's shelf.

Vijay K. Goel, PhD
Professor and Chair, Department of Bioengineering,
University of Toledo; Professor and Co-Director,
Spine Research Center, Department of Orthopedics,
Medical University of Ohio, Toledo, Ohio

Christian R. Etter, MD
Chairman, Swiss Spine Clinic,
Zurich, Switzerland;
Chief, Department of Spinal Medicine,
Hirslanden Clinic, Aarau, Switzerland;
Founding President, Swiss Spine Institute