Electrophysiological stimulation and recording was used in the operating room by researchers as early as the 1930s to study the functional organization of the cerebral cortex [1–4]. Seminal studies by scientists such as Penfield and Celesia led to our modern understanding of the functional organization of the cerebral cortex. This early work paved the way for further investigations into the utility of intraoperative electrophysiological recordings in protecting the nervous system during surgery. By the 1960s, facial nerve stimulation was being used during surgery for vestibular schwannoma to prevent postoperative facial nerve palsies [5, 6].

In the 1980s, brainstem auditory evoked potentials and somatosensory evoked potentials were introduced to protect the spinal cord and brainstem during surgery [7–9]. The application of intraoperative monitoring modalities began to cross into specialties other than neurosurgery such as orthopedics and ENT. This technology was still mostly available only at larger academic medical centers.

The 1990s ushered in a stage of rapid growth for the field of intraoperative monitoring. The advent of transcranial electrical stimulation provided a new means for monitoring the motor system during surgery [10]. Intraoperative monitoring began to move from the academic centers into community hospitals. This was made possible by the entry of private enterprise into the field, and with this growth came the demand for a skilled workforce. Traditionally dominated by physicians and neurophysiologists, the field now incorporated skilled technologists under the supervision of one of the physicians or PhD neurophysiologists.

Continued growth led to two new challenges in the delivery of IOM services to new markets: lack of formal training for IOM technologists and insufficient professional oversight. To a great extent, these problems are still present today. Someone interested in becoming an IOM technologist generally has to find a position with a company that has a quality training program. Corporate training programs range from the “see one, do one, teach one” model all the way to rigorous academic-quality programs. There are efforts to establish an academic path for people wanting to become IOM technologists. With job growth set to outpace qualified technologists, this problem will force a solution.

The problem of insufficient oversight was temporarily solved in the 1990s and early 2000s with the advent of real-time remote monitoring (RTM).
allowing the physician or neurophysiologist to monitor a case (or multiple cases simultaneously) and provide interpretation to the technologist and surgeon in real time. Once considered a luxury, RTM has become a community standard available nationwide. Currently only physicians are reimbursed for RTM, but a changing reimbursement climate and shortage of qualified physicians are posing a danger to patient access to RTM nationwide. In time it is likely that nonphysician providers, such as PhD neurophysiologists, will be reimbursed for providing RTM services.

Intraoperative monitoring is now entering a new and critical phase of growth. Emerging technology and advances in neuroscience research are creating exciting opportunities for the field of IOM. Neurophysiologists are working alongside neurosurgeons to map subcortical brain structures and identify therapeutic targets for treatment of movement and affective disorders. New minimally invasive surgical procedures are making recovery times shorter and reducing postoperative pain. These new procedures require different approaches to spinal cord and nerve root monitoring that will ultimately make spine surgery even safer. Finally, we are gaining more knowledge of basic neurophysiological function of patients under general anesthesia that will lead to new ways to monitor the nervous system. The study of spinal reflexes in the anesthetized patient is one promising example of the ongoing research that makes IOM an exciting and dynamic field.

The field of intraoperative monitoring requires foundational knowledge of several disciplines such as anatomy, physiology, surgery, electronics and instrumentation, and anesthesia. This book was conceived as a resource for a diverse audience. Primarily intended as a textbook for use in academic courses in intraoperative monitoring or in corporate training programs, this book is unique in that it provides a comprehensive section on anatomy and cellular neurophysiology relevant to the IOM clinician. This book is intended to be highly “reader friendly” and attempts to provide the didactic and practical principles needed for a new IOM clinician, experienced clinicians, anesthesiologists, and surgeons interested in intraoperative monitoring. Physicians, neurophysiologists, and technologists preparing for board exams will also find this text very useful. Basic didactic concepts presented in early chapters are brought together into practical chapters on intraoperative monitoring and mapping. Chapters covering electrophysiological assessment of spinal cord pathology and the treatment of pain round out this book and will be highly useful to anesthesiologists and residents interested in diagnosing and treating chronic pain.

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References
