# Preface

We have witnessed tremendous technological advances since the first neonatal patients were mechanically ventilated in the late 1960s using modifications of devices built for adults. Even after the advent of infant-specific ventilators, patient assessment was rudimentary, consisting of the clinical examination and the occasional chest radiograph and blood gas analysis. A key concept was missing in this initial approach. The mechanical ventilator at that time worked best with a passive subject. However, unless pharmacological paralysis was used (which it often was), the spontaneously breathing infant was anything but passive, trying to breathe while the ventilator tried to assist, but seldom at the same time. The concept of patient–ventilator interaction was born. First-generation equipment to measure pulmonary mechanics appeared in the late 1970s but was cumbersome, difficult to calibrate, and often gave unreliable or irreproducible data. The introduction of the microprocessor in the 1980s was a giant leap forward, enabling breath-to-breath bedside assessment of the baby and the ventilator for the first time. This included measurements and displays of valuable information about lung mechanics, patient–ventilator synchrony, and the response to different ventilation strategies and pharmacological interventions. Ventilation of the neonatal patient finally moved from "one size fits all" to customized strategies based on the underlying pathophysiology and the baby's response to intervention.

Although bedside assessment of lung mechanics and patient–ventilator interaction initially relied on stand-alone devices with a display screen and portable computer that was tediously rolled from bed to bed, by the 1990s ventilator manufacturers began to recognize the need for continuous monitoring and added graphic monitors to mechanical ventilators. This allowed a visual representation of what was happening with—and between—each ventilator cycle. Clinicians became able to diagnose conditions like gas trapping before it resulted in air leak and to evaluate the best mode or modality for the individual patient. Unfortunately, there was a lack of both acceptance and understanding of pulmonary graphics as an adjunct to mechanical ventilation. Surprisingly, many today are still uncertain how this real-time information should be used to understand and manage neonatal respiratory treatments.

We undertook this project to further the understanding of pulmonary graphics. Graphics are all about pattern recognition. We have assembled an atlas of patterns commonly encountered in neonatal practice in a format that displays actual screenshots with an accompanying schematic, which dissects the graphic and illustrates its key features. The chapters have been arranged to demonstrate the principles of real-time pulmonary graphics, a discussion of waveforms and loops, and how they are both affected by mechanical ventilation and disease states. We conclude with a series of clinical cases to illustrate some key points.

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experiences with pulmonary graphics as we spent many exciting hours really learning respiratory physiology. We have both been fortunate to work with forward-thinking neonatologists, in particular the late Stephen Boros, who saw the potential value of graphics and enabled us to pursue our work in this area.

It is our hope that this atlas will be of assistance in the management of neonatal ventilation and will lead to better and safer outcomes for your patients.

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