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Edited by J. S. Gravenstein, Michael B. Jaffe, Nikolaus Gravenstein and David A. Paulus

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## Preface

This book explores carbon dioxide physiology, monitoring, and its operative as well as non-operative applications. In this text, we have considered both applications in which capnography has gained a foothold, and is fast becoming a standard of care, and its use in newer, emerging applications. The diversity contained within this edition calls for wide-ranging expertise. We were fortunate to have persuaded over 40 specialists to chronicle their findings in utilizing capnography in essays that we believe could each stand as independent reports. As a consequence, this book may seem, in some respects, more of a symposium than a textbook on the application of capnography in healthcare. For the reader's comfort, we have accepted some overlap and repetition. Differences in perspectives, inherent in the backgrounds of the contributing authors, have also been allowed. We are particularly pleased with the historical section of the book, in which unique contributions from some of the pioneers of capnography offer personal accounts and experiences.

In the last few years since the publication of the first edition, we have seen expansion in the recognition of capnography's value and its applications. For the second edition, we have endeavored to update the first edition to reflect this evolution. Most chapters have been revised, and several have been completely rewritten. We have also added chapters to fill gaps identified in the first edition and to explore additional emerging and noteworthy applications. The basic organization of the text remains the same as envisioned by

J. S. Gravenstein who passed away after an extended illness during the preparation of this edition. While the first edition was being generated, he explained how he viewed carbon dioxide in such a clear and wonderful context that we readily adopted that organization for the clinical section of the text.

*CO<sub>2</sub> has four stories to tell: The first, starting from the outside, deals with the adequacy of breathing (and the occasional problem of rebreathing), that is, with the transport of the gas from within the body to the outside. The next story has to do with transport of CO<sub>2</sub> in the body, bringing the gas to the lungs, which is dealing with the circulation and particularly with pulmonary blood flow. It includes the business of how CO<sub>2</sub> is transported in the blood. The third story has to do with the production of CO<sub>2</sub>, which has to do with metabolism and temperature. The fourth story deals with the effects of CO<sub>2</sub> itself on the body, where it not only drives the respiratory system, but can produce mischief by changing the pH, blood flow to the brain, and affecting the lungs.*

We will always remember J. S. for his wisdom, insightful advice, humor, and, most of all, his friendship.

M. B. Jaffe  
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We would like to express our gratitude to Hope Olivo, Editor in the Department of Anesthesiology at the University of Florida College of Medicine, whose invaluable assistance allowed the editors and contributors to complete this second edition in a timely manner.

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## Commonly used abbreviations

$\text{CaO}_2$	Oxygen concentration, arterial
CL	Lung compliance
$\text{FECO}_2$	Fractional concentration of carbon dioxide in expired gas
FEV	Forced expiratory volume
$\text{FEV}_1$	Forced expiratory volume in 1 second; forced expiratory volume in the first second
$\text{FiO}_2$	Fraction of inspired oxygen
FRC	Functional residual capacity
FVC	Forced vital capacity
$\text{PaCO}_2$	Partial pressure of carbon dioxide in arterial blood
$\text{PACO}_2$	Partial pressure of carbon dioxide in alveolar gas
$\text{PAO}_2$	Partial pressure of oxygen in the alveoli
$\text{PAO}_2 - \text{PaO}_2$	Alveolar–arterial difference in partial pressure of oxygen
P <sub>B</sub>	Barometric pressure
$\text{P}_{\text{E}_{\text{max}}}$	Maximum expiratory pressure
$\text{PETCO}_2$	Partial pressure of carbon dioxide at end-tidal
$\text{P}_{\text{I}_{\text{max}}}$	Maximum inspiratory pressure
$\text{P}\bar{\text{v}}\text{O}_2$	Partial pressure of oxygen, mixed venous
$\text{R}_{\text{aw}}$	Airway resistance
TLC	Total lung capacity
$\text{V}_A$	Alveolar ventilation
VC	Vital capacity
$\dot{\text{V}}_E$	Expired volume per unit time
$\dot{\text{V}}\text{O}_2$	Oxygen consumption per unit time
$\dot{\text{V}}\text{O}_{2\text{max}}$	Maximum oxygen consumption
$\text{V}_T$	Tidal volume
$\dot{\text{V}}/\dot{\text{Q}}$	Ventilation–perfusion ratio