

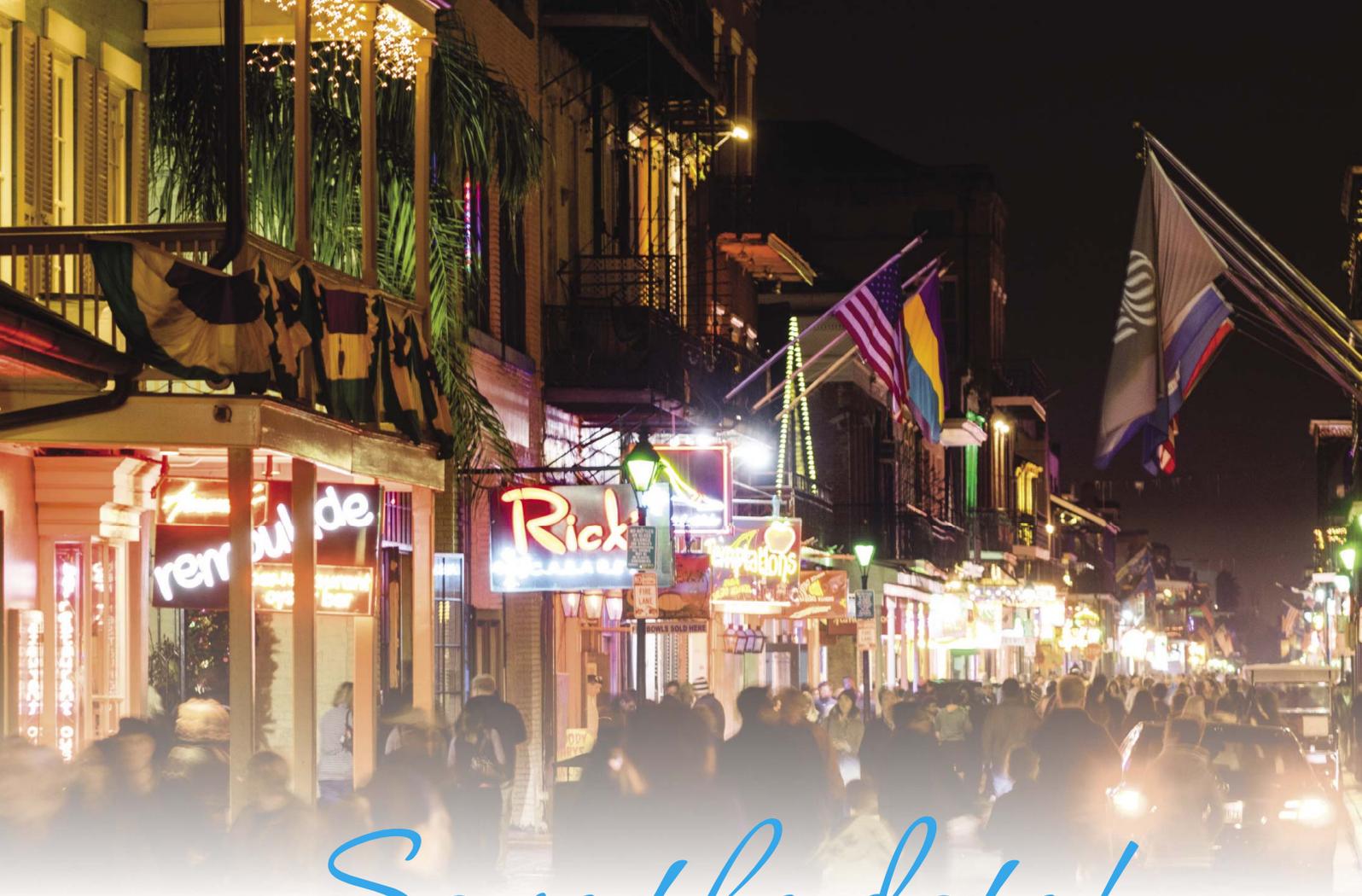
Volume 37, No 9

ICHE



FLORENCE NIGHTINGALE

SEPTEMBER 2016



Save the date!

October 26-30 • New Orleans, LA • www.idweek.org



IDWeek ²⁰¹⁶™

Advancing Science, Improving Care

Register by September 23 and save!

Earn up to 42 CME credits

A JOINT MEETING OF



CONTENTS

Original Articles

- 1005** Cardiac Electrophysiology Laboratories: A Potential Target for Antimicrobial Stewardship and Quality Improvement?
Westyn Branch-Elliman, Maggie Stanislawski, Judith Strymish, Anna E. Barón, Kalpana Gupta, Paul D. Varosy, Howard S. Gold and P. Michael Ho
- 1012** Cost-Effectiveness Analysis of Safety-Engineered Devices
Haruhisa Fukuda and Kensuke Moriwaki
- 1022** Personal Protective Equipment for Infectious Disease Preparedness: A Human Factors Evaluation
Tracey A. Herlihey, Stefano Gelmi, Christopher J. Flewelling, Trevor N. T. Hall, Carleene Bañez, Plinio P. Morita, Paul Beverley, Joseph A. Cafazzo and Susy Hota
- 1029** Impact of a Central Line Infection Prevention Bundle in Newborn Infants
Rowena McMullan and Adrienne Gordon
- 1037** Evaluating the Accuracy of Sampling Strategies for Estimation of Compliance Rate for Ventilator-Associated Pneumonia Process Measures
Adam Diehl, Ting Yang, Kathleen Speck, James Battles, Sara E. Cosgrove, Sean Berenholtz and Michael Klompas
- 1044** Evaluating a Hospitalist-Based Intervention to Decrease Unnecessary Antimicrobial Use in Patients With Asymptomatic Bacteriuria
Sarah E. Hartley, Latoya Kuhn, Staci Valley, Laraine L. Washer, Tejal Gandhi, Jennifer Meddings, Michelle Robida, Salas Sabnis, Carol Chenoweth, Anurag N. Malani, Sanjay Saint and Scott A. Flanders
- 1052** The Value of E-Learning for the Prevention of Healthcare-Associated Infections
Sonia O. Labeau, Jordi Rello, George Dimopoulos, Jeffrey Lipman, Akline Sarikaya, Candan Oztürk, Dominique M. Vandijck, Dirk Vogelaers, Koenraad Vandewoude and Stijn I. Blot for the EVIDENCE Research Team
- 1060** National Bloodstream Infection Surveillance in Switzerland 2008–2014: Different Patterns and Trends for University and Community Hospitals
Niccolò Buetti, Jonas Marschall, Andrew Atkinson and Andreas Kronenberg Swiss Centre for Antibiotic Resistance (ANRESIS)
- 1068** The Economic Burden of Hospital-Acquired *Clostridium difficile* Infection: A Population-Based Matched Cohort Study
Natasha Nanwa, Jeffrey C. Kwong, Murray Krahn, Nick Daneman, Hong Lu, Peter C. Austin, Anand Govindarajan, Laura C. Rosella, Suzanne M. Cadarette and Beate Sander
- 1079** Cost-Effectiveness Analysis of the Use of Probiotics for the Prevention of *Clostridium difficile*-Associated Diarrhea in a Provincial Healthcare System
Jenine R. Leal, Steven J. Heitman, John M. Conly, Elizabeth A. Henderson and Braden J. Manns
- 1087** *Clostridium difficile* Infections in Children: Impact of the Diagnostic Method on Infection Rates
Mohammad AlGhounaim, Yves Longtin, Milagros Gonzales, Joanna Merckx, Nicholas Winters and Caroline Quach

Concise Communications

- 1094** Incidence and Risk Factors for Infection Following Transcatheter Aortic Valve Implantation
Yuhao Shi, Harindra C. Wijesundera, Stephen E. Fremes and Andrew E. Simor
- 1098** Understanding Inpatient Perceptions of Indwelling Urinary Catheters Using the Health Belief Model
Joshua Quast, Mary Jo Knobloch, Erin Patterson, Suzanne Purvis, Daniel Shirley and Nasia Safdar
- 1101** Evaluation of a Healthcare-Associated Urinary Tract Infection Combination Antibigram
Jenna Wick, Kirthana Beaulac and Shira Doron

- 1105** Policies for Controlling Multidrug-Resistant Organisms in US Healthcare Facilities Reporting to the National Healthcare Safety Network, 2014
Lindsey M. Weiner, Amy K. Webb, Maroya S. Walters, Margaret A. Dudeck and Alexander J. Kallen
- 1109** *Commentary*: Potential Uses of a National Healthcare-Associated Infection Reporting System
Graham M. Snyder and Daniel J. Morgan
- 1111** Hidden Reservoir: An Outbreak of Tuberculosis in Hospital Employees with No Patient Contact
Riley Hazard, Kyle B. Enfield, Darla J. Low, Eve T. Giannetta and Costi D. Sifri

Research Briefs

- 1114** Controlling Nosocomial Transmission of Drug-Resistant Pathogens at Different Endemic Stages in a Resource-Limited Setting
Abigail L. Carlson, Nattapol Pruetpongpan, Aubonphan Buppajarntham and Anucha Apisarnthanarak
- 1116** Trends in Chlorhexidine Use in US Neonatal Intensive Care Units: Results From a Follow-Up National Survey
Julia Johnson, Rebecca Bracken, Pranita D. Tamma, Susan W. Aucott, Cynthia Bearer and Aaron M. Milstone
- 1118** Reduction in Acute Respiratory Infection Among Military Trainees: Secondary Effects of a Hygiene-Based Cluster-Randomized Trial for Skin and Soft-Tissue Infection Prevention
Eugene V. Millar, Carey D. Schlett, Natasha N. Law, Wei-Ju Chen, Michael J. D’Onofrio, Jason W. Bennett, David R. Tribble and Michael W. Ellis

Letters to the Editor

- 1121** Response to “Potential Misclassification of Urinary Tract Related Bacteremia Upon Applying the 2015 Catheter-Associated Urinary Tract Infection Surveillance Definition From the National Healthcare Safety Network”
Katherine Allen-Bridson and Daniel Pollock
- 1122** Response to Allen-Bridson and Pollock
M. Todd Greene, Mohamad G. Fakhri and Sanjay Saint
- 1122** Accounting for Competing Events in Multivariate Analyses of Hospital-Acquired Infection Risk Factors
Martin Wolkewitz
- 1124** Reply to Wolkewitz: When to Use Cumulative Risk-Based Versus Rate-Based Approaches in the Analysis of Hospital-Acquired Infection Risk Factors? That Depends on the Question
Kevin A. Brown, Nick Daneman, Vanessa Stevens, Tom H. Greene and Paul Arora
- 1125** Surveillance for Ventilator-Associated Pneumonia: Can We Apply Centers for Disease Control and Prevention–National Healthcare Safety Network 2013 Definitions for All Settings?
Gökhan Metan, Hümeysra Zengin, Burcu Çınar, Hanife Aytac, Mutlu Hayran and Serhat Ünal
- 1127** Relation of Diagnostic Accuracy of Viral Respiratory Polymerase Chain Reaction to Specimen Number and Source in Severe Adenovirus Pneumonia: Antimicrobial Stewardship Implications
Cheston B. Cunha
- 1129** Fecal Microbiota Therapy as Rescue Therapy for Life-Threatening *Clostridium difficile* Infection in the Critically Ill: A Small Case Series
Sebastian Schulz-Stübner, Zoran Textor and Martin Anetseder
- 1131** Specialty, but Not Age, Is Related to Provider Hand Hygiene Compliance
Rohit M. Modak, Bijal Rajput, Ian A. Seemungal, Bryan Ennis and Laurel Cushing

Errata

- 1133** Cost-Effectiveness Analysis of the Use of Probiotics for the Prevention of *Clostridium difficile*–Associated Diarrhea in a Provincial Healthcare System – ERRATUM
Jenine R. Leal, Steven J. Heitman, John M. Conly, Elizabeth A. Henderson, and Braden J. Manns
- 1134** Assessment of Time to Clinical Response in Patients with Sepsis Treated Before and After Implementation of a Matrix-Assisted Laser Desorption Ionization Time-of-Flight Blood Culture Identification Algorithm – ERRATUM
Joseph J. Carreno, Ben M. Lomaestro, Apryl L. Jacobs, Rachel E. Meyer, Ann Evans and Clemente I. Montero

An Official Publication of the Society for Healthcare Epidemiology of America

EDITOR

Suzanne F. Bradley, MD • Ann Arbor, MI

DEPUTY EDITOR

Carol A. Kauffman, MD • Ann Arbor, MI

SENIOR ASSOCIATE EDITORS

C. Glen Mayhall, MD • Galveston, TX
Gina Pugliese, RN, MS • Chicago, IL
William Schaffner, MD • Nashville, TN

ASSOCIATE EDITORS

Carol Chenoweth, MD • Ann Arbor, MI
Ebbing Lautenbach, MD, MPH • Philadelphia, PA
David Weber, MD, MPH • Chapel Hill, NC

STATISTICS CONSULTANTS

Jon P. Furuno, PhD • Portland, OR
Jessina C. McGregor, PhD • Portland, OR

SECTION EDITOR FOR GUIDELINES, POSITION PAPERS, AND INVITED REVIEWS

Eli Perencevich, MD, MS • Iowa City, IA

MANAGING EDITOR

Meighan Schreiber, MSSA • New York, NY

PAST EDITORS

Infection Control

Richard P. Wenzel, MD, 1980-1987 (vols. 1-8)

Infection Control & Hospital Epidemiology

Richard P. Wenzel, MD, 1988-1992

(vols. 9-13)

Michael D. Decker, MD, 1993-2001 (vols. 14-22)

Barry M. Farr, MD, 2002-2004 (vols. 23-25)

William R. Jarvis, MD, 2005-2006 (vols. 26 and 27)

EDITORIAL ADVISORY BOARD

Deverick Anderson, MD, MPH • Durham, NC
Anucha Apisarnthanarak, MD • Pratumthani, Thailand
Lennox Archibald, MD, FRCP • Alachua, FL
Shailen Banerjee, PhD • Atlanta, GA
Elise M. Beltrami, MD, MPH • Atlanta, GA
Jo Anne Bennett, RN, PhD • New York, NY
David Birnbaum, PhD, MPH • Sidney, BC
Marc Bonten, MD • Utrecht, Netherlands
Christian Brun-Buisson, MD • Creteil, France
John P. Burke, MD • Salt Lake City, UT
David P. Calfee, MD, MS • New York, NY
Yehuda Carmeli, MD, MPH • Tel Aviv, Israel
Donald E. Craven, MD • Burlington, MA
Christopher Crnich, MD, MS • Madison, WI
Erika D'Agata, MD, MPH • Boston, MA
Daniel Diekema, MD • Iowa City, IA
Erik Dubberke, MD, MSPH • St. Louis, MO
Charles E. Edmiston, Jr., PhD • Milwaukee, WI
Theodore C. Eickhoff, MD • Denver, CO
Mohamad Fakhri, MD, MPH • Grosse Pointe Woods, MI
Petra Gastmeier, MD • Berlin, Germany
Jeffrey Gerber, MD, PhD • Philadelphia, PA
Dale N. Gerding, MD • Hines, IL
Donald A. Goldmann, MD • Boston, MA
Nicholas Graves, PhD • Brisbane, Australia
Donna Haiduvén, RN, PhD, CIC • Tampa, FL
Anthony D. Harris, MD, MPH • Baltimore, MD
Elizabeth Henderson, PhD • Calgary, AB
David K. Henderson, MD • Bethesda, MD
Loreen A. Herwaldt, MD • Iowa City, IA
Peter N. R. Hestline, MD • Brea, CA

John A. Jernigan, MD, MS • Atlanta, GA
Mini Kamboj, MD • New York, NY
James T. Lee, MD, PhD • St. Paul, MN
L. Clifford McDonald, MD • Atlanta, GA
Allison McGeer, MD • Toronto, ON
Leonard A. Mermel, DO, ScM • Providence, RI
Robert R. Muder, MD • Pittsburgh, PA
Linda Mundy, MD • Collegeville, PA
Joseph M. Mylotte, MD, CIC • Buffalo, NY
Jan Evans Patterson, MD • San Antonio, TX
David A. Pegues, MD • Philadelphia, PA
Didier Pittet, MD, MS • Geneva, Switzerland
Isaam Raad, MD • Houston, TX
Manfred L. Rotter, MD, DipBact • Vienna, Austria
William A. Rutala, PhD, MPH • Chapel Hill, NC
Lisa Saiman, MD, MPH • New York, NY
Sanjay Saint, MD, MPH • Ann Arbor, MI
Sorana Segal-Maurer, MD • Flushing, NY
Lynne M. Schulster, PhD • Atlanta, GA
John A. Sellick, DO • Amherst, NY
Andrew E. Simor, MD • Toronto, ON
Philip W. Smith, MD • Omaha, NE
Kurt Stevenson, MD, MPH • Columbus, OH
Nimalie Stone, MD • Atlanta, GA
Thomas Talbot, MD, MPH • Nashville, TN
Paul Tambyah, MBBS • Singapore
William Trick, MD • Chicago, IL
Antoni Trilla, MD, PhD • Barcelona, Spain
Robert A. Weinstein, MD • Chicago, IL
Andreas Widmer, MD, MS • Basel, Switzerland
Marcus Zervos, MD • Detroit, MI

Infection Control & Hospital Epidemiology (ISSN 0899-823X) is published monthly by Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA.

Editorial Office

Communications should be addressed to the Editor, *Infection Control & Hospital Epidemiology*, One Liberty Plaza, New York, NY 10006 (email: mschreiber@cambridge.org; telephone: 212-337-5954, fax: 212-337-5959). Contributors should consult the Instructions for Contributors, which is available at the journal's Web site.

Advertising

Please direct advertising inquiries to M. J. Mrvica Associates, 2 West Taunton Avenue, Berlin, NJ 08009 (e-mail: mjmrvica@mrvica.com; telephone: 856-768-9360, fax: 856-753-0064). Publication of an advertisement in *Infection Control & Hospital Epidemiology* does not imply endorsement of its claims by the Society for Healthcare Epidemiology of America, by the Editor, or by Cambridge University Press.

Permissions

Articles may be copied or otherwise reused without permission only to the extent permitted by Sections 107 and 108 of the US Copyright Law. Permission to copy articles for personal, internal, classroom, or library

use may be obtained from the Copyright Clearance Center (<http://www.copyright.com>, email: info@copyright.com). For all other uses, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, please contact Cambridge University Press. Full details may be found at: www.cambridge.org/about-us/rights-permissions.

Subscriptions

The individual subscription rate for 2016 is \$235. Individuals have the option to order directly from Cambridge University Press. Institutional print + electronic and e-only subscriptions are available from Cambridge University Press and include unlimited online access; rates are tiered according to an institution's type and research output and may be reviewed at the journal's CJO homepage: <http://journals.cambridge.org/ICE>.

Please direct subscription inquiries and requests for back issues to Customer Services at Cambridge University Press, e-mail: subscriptions_newyork@cambridge.org (USA, Canada, and Mexico) or journals@cambridge.org (outside of USA, Canada, and Mexico).

Postmaster: Send address changes to *Infection Control & Hospital Epidemiology*, Cambridge University Press, One Liberty Plaza, New York, NY 10006 USA.

About the cover:



The cover format of each volume of *Infection Control & Hospital Epidemiology* honors one of the many professionals throughout history who recognized not only how disease might be spread but also how the principles of epidemiology could be applied to reduce healthcare-associated infections.

Florence Nightingale (1820–1910) was named after the Italian city where she was born to affluent and well-educated English landowners. As a middle-class woman in Victorian England, Florence recognized that she was destined for a life of domesticity and “trivial occupations.” Her choice of nursing, given its reputation at the time as a vocation for poor elderly spinsters, was met with significant familial opposition. During her European travels, Ms. Nightingale visited the Deaconess Mutterhaus in Kaiserswerth, Düsseldorf, one of the most forward thinking nursing training schools of the day. She returned to Düsseldorf to complete her training and then studied with the Sisters of Charity in Paris. She later assumed the role of superintendent at a hospital for invalid gentlewomen in London.

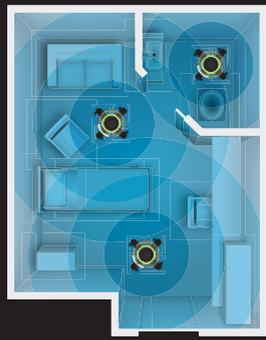
In 1854, the Minister of War invited Ms. Nightingale to oversee the introduction of nurses at British Army hospitals in Scutari, Turkey. Up to that point, 20% of men who fought in the Crimean War died, and approximately 70% of those deaths were due to infections such as typhus, cholera, typhoid, and dysentery. The germ theory of disease had not yet been formulated, but Florence Nightingale recognized that most problems were caused by “inadequate diet, dirt, and drains.” She adopted the concept of “sanitary nursing” ensuring that patient care focused on prevention of infection through adequate diet, fresh air, light, warmth, and cleanliness. She was an early advocate for hand hygiene and the need for clean water, adequate ventilation, and appropriate sewage disposal. Each night, she traveled through more than 6 km of hospital wards carrying a Turkish lamp; thus the media referred to her as “The Lady with the Lamp.” With her interventions, mortality rates declined to 2%–6%.

In response, a grateful nation raised £50,000 for the Nightingale Fund, and the first professional training school for nurses at St. Thomas’ Hospital, London, was established under her direction. Florence Nightingale was one of the first to apply statistical analysis to her observations. She made important recommendations regarding the optimal design of hospitals and patient wards, saying, “The very first requirement in a hospital is that it should do the sick no harm.” Training schools have been established worldwide based on her ideas. Florence Nightingale was the first woman to receive Britain’s highest civilian decoration, the Order of Merit. She died at the age of 90 after many years of being bed-ridden due to chronic illness, possibly brucellosis.

surfacide®

3 ARE BETTER THAN 1

surfacide®



Standard UV Room Cleaning



Surfacide contributes to 41% reduction in *C.diff* infection rates for Faxton St. Luke's Hospital and \$1.4 million in cost avoidance for hospital-onset *Clostridium difficile*.

— Bernard H, Little J. The Impact of Ultraviolet (UV) Disinfection System Coupled with Evidence-based Interventions on the Incidence of Hospital Onset Clostridium Difficile (HO-C-Diff). *Am J Infect Control*. 2015;43(6):S27.



**To schedule a live demonstration,
call toll free: 844-390-3538**

Surfacide.com

OUT NOW!

MOLECULAR PATHOLOGY

Edited by **John M. S. Bartlett**,

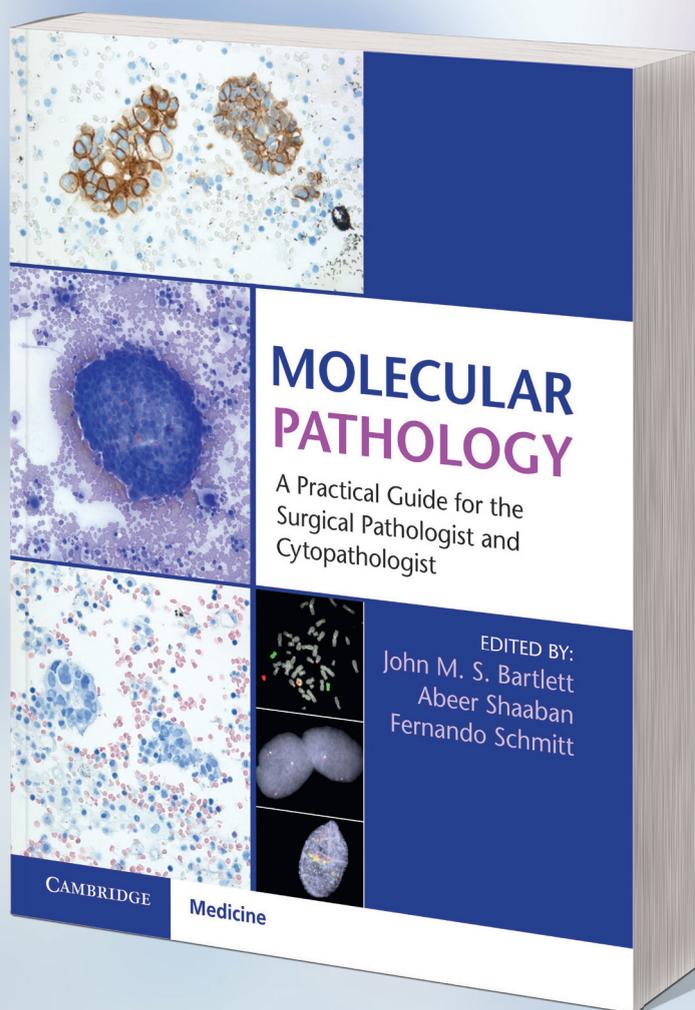
Ontario Institute for Cancer Research, Toronto

Abeer Shaaban,

University Hospitals Birmingham NHS Foundation Trust

Fernando Schmitt,

Laboratoire National de Santé, Luxembourg



This practical manual provides a comprehensive yet concise guide to state-of-the-art molecular techniques and their applications. It starts with an overview of the essential principles of molecular techniques, followed by separate chapters detailing the use of these techniques in particular tissues and organs, and describing recommended treatment plans. Each chapter covers the tests available, their advantages, limitations, and use as diagnostic and prognostic tools, with key learning points at the end of each topic. Using both histologic and cytologic samples, it discusses how to interpret test results in a pathologic context and enables trainees and practicing pathologists to gain an in-depth understanding of molecular diagnostic techniques and how to incorporate them into routine diagnostic practice. Aiding the daily practice of refining diagnosis, as well as offering a didactic approach, this book is an essential reference for practicing pathologists and cytopathologists as well as trainees in pathology.

- Offers a system-specific molecular approach in tissues and cytological preparations and covers current and future trends in molecular pathology to familiarize pathologists and cytopathologists with molecular diagnostic and prognostic criteria
- Describes the application of molecular techniques in diagnostic histopathology, cytopathology and clinical management
- Each chapter ends with a set of key learning points, offering a summary as well as a learning tool to surgical pathologists and cytopathologists

Print/Online Bundle

414 pages / 86 color illus. 38 tables

9781107443464 / \$135.00 / £84.99

For more information, please go to
www.cambridge.org/molecularp pathology



CAMBRIDGE
UNIVERSITY PRESS