

ANESTHESIOLOGY

Trusted Evidence: Discovery to Practice®

The Official Journal of the American Society of Anesthesiologists anesthesiology.org

Mission: Promoting scientific discovery and knowledge in perioperative, critical care, and pain medicine to advance patient care.

EDITOR-IN-CHIEF

Evan D. Kharasch, M.D., Ph.D.
Editor-in-Chief, ANESTHESIOLOGY
Department of Anesthesiology
Duke University
Durham, North Carolina
Tel: 1-800-260-5631
E-mail: editorial-office@anesthesiology.org

PAST EDITORS-IN-CHIEF

Henry S. Ruth, M.D., 1940–1955
Ralph M. Tovell, M.D., 1956–1958
James E. Eckenhoff, M.D., 1959–1962
Leroy D. Vandam, M.D., 1963–1970
Arthur S. Keats, M.D., 1971–1973
Nicholas M. Greene, M.D., 1974–1976
C. Philip Larson, Jr., M.D., 1977–1979
John D. Michenfelder, M.D., 1980–1985
Lawrence J. Saidman, M.D., 1986–1996
Michael M. Todd, M.D., 1997–2006
James C. Eisenach, M.D., 2007–2016

COVER ART

James P. Rathmell, M.D., Boston, Massachusetts
Annemarie B. Johnson,
Medical Illustrator, Winston-Salem, North Carolina

For reprint inquiries and purchases, please contact
reprintsolutions@wolterskluwer.com in North America, and
healthlicensing@wolterskluwer.com for rest of world.

Anesthesiology is abstracted or indexed in Index Medicus/MEDLINE, Science Citation Index/SciSearch, Current Contents/Clinical Medicine, Current Contents/Life Sciences, Reference Update, EMBASE/Excerpta Medica, Biological Abstracts (BIOSIS), Chemical Abstracts, Hospital Literature Index, and Comprehensive Index to Nursing and Allied Health Literature (CINAHL).

The affiliations, areas of expertise, and conflict-of-interest disclosure statements for each Editor and Associate Editor can be found on the Journal's Web site (www.anesthesiology.org).

CME EDITORS

Leslie C. Jameson, M.D.
Dan J. Kopacz, M.D.

EDITORIAL OFFICE

Rebecca Benner, Managing Editor
E-mail: managing-editor@anesthesiology.org
Loretta Pickett, Assistant Managing Editor
Gabrielle McDonald, Digital Communications Specialist
Caitlin Washburn
ANESTHESIOLOGY Journal
1061 American Lane
Schaumburg, IL 60173-4973
Tel: 1-800-260-5631
E-mail: editorial-office@anesthesiology.org

WOLTERS KLUWER HEALTH PUBLICATION STAFF

Ryan Shaw, Senior Publisher
Cheryl Stringfellow, Senior Journal Production Editor
Laura Mitchell, Journal Production Editor
Lori Querry, Journal Production Associate
Kelle Gray, National Account Manager

ASA OFFICERS

Michael W. Champeau, M.D., FAAP, FASA, President
Ronald L. Harter, M.D., FASA, President-Elect
Randall M. Clark, M.D., FASA, Immediate Past President
Donald E. Arnold, M.D., FASA, First Vice President

All articles accepted for publication are done so with the understanding that they are contributed exclusively to this Journal and become the property of the American Society of Anesthesiologists. Statements or opinions expressed in the Journal reflect the views of the author(s) and do not represent official policy of the American Society of Anesthesiologists unless so stated.

ANESTHESIOLOGY

Trusted Evidence: Discovery to Practice[®]

The Official Journal of the American Society of Anesthesiologists anesthesiology.org

Mission: Promoting scientific discovery and knowledge in perioperative, critical care, and pain medicine to advance patient care.

EDITOR-IN-CHIEF

Evan D. Kharasch, M.D., Ph.D., Durham, North Carolina

ASSISTANT EDITOR-IN-CHIEF

Michael J. Avram, Ph.D., Chicago, Illinois

EXECUTIVE EDITORS

Deborah J. Culley, M.D., Philadelphia, Pennsylvania

Andrew Davidson, M.B.B.S., M.D., Victoria, Australia

Jerrold H. Levy, M.D., Durham, North Carolina

Laszlo Vutskits, M.D., Ph.D., Geneva, Switzerland

EDITORS

Brian T. Bateman, M.D., Stanford, California

Amanda A. Fox, M.D., M.P.H., Dallas, Texas

Yandong Jiang, M.D., Ph.D., Houston, Texas

Sachin Kheterpal, M.D., M.B.A., Ann Arbor, Michigan

Martin J. London, M.D., San Francisco, California

Kristin Schreiber, M.D., Ph.D., Boston, Massachusetts

Jamie W. Sleigh, M.D., Hamilton, New Zealand

STATISTICAL EDITOR

Timothy T. Houle, Ph.D., Boston, Massachusetts

CREATIVE AND MULTIMEDIA EDITOR

James P. Rathmell, M.D., Boston, Massachusetts

ASSOCIATE EDITORS

Takashi Asai, M.D., Ph.D., Osaka, Japan

Beatrice Beck-Schimmer, M.D., Zurich, Switzerland

James M. Blum, M.D., Atlanta, Georgia

Sorin J. Brill, M.D., Jacksonville, Florida

Chad Michael Brummett, M.D., Ann Arbor, Michigan

John Butterworth, M.D., Richmond, Virginia

Maxime Cannesson, M.D., Ph.D., Los Angeles, California

Maurizio Cereda, M.D., Boston, Massachusetts

Vincent W. S. Chan, M.D., Toronto, Canada

Steven P. Cohen, M.D., Baltimore, Maryland

Melissa L. Coleman, M.D., Hershey, Pennsylvania

Albert Dahan, M.D., Ph.D., Leiden, The Netherlands

Sharon Einav, M.Sc., M.D., Jerusalem, Israel

Douglas Eleveld, M.D., Groningen, The Netherlands

Holger K. Eitzschig, M.D., Ph.D., Houston, Texas

Charles W. Emala, Sr., M.D., M.S., New York, New York

David Faraoni, M.D., Ph.D., Houston, Texas

Ana Fernandez-Bustamante, M.D., Ph.D., Aurora, Colorado

Julia Alejandra Gálvez Delgado, M.D., M.B.I., Omaha, Nebraska

Laurent Glance, M.D., Rochester, New York

Stephen T. Harvey, M.D., Nashville, Tennessee

Harriet W. Hopf, M.D., Salt Lake City, Utah

Vesna Jevtovic-Todorovic, M.D., Ph.D., M.B.A., Aurora, Colorado

Ru-Rong Ji, Ph.D., Durham, North Carolina

Cor J. Kalkman, M.D., Utrecht, The Netherlands

Karim Ladha, M.D., M.Sc., Toronto, Canada

Meghan Lane-Fall, M.D., M.H.S.P., Philadelphia, Pennsylvania

Adam B. Lerner, M.D., Boston, Massachusetts

Kate Leslie, M.B.B.S., M.D., M.Epi., Melbourne, Australia

Philipp Lirk, M.D., Ph.D., Boston, Massachusetts

George A. Mashour, M.D., Ph.D., Ann Arbor, Michigan

Michael Mazzeffi, M.D., M.P.H., M.Sc., Charlottesville, Virginia

Daniel McIsaac, M.D., M.P.H., Ottawa, Canada

Jane S. Moon, M.D., Los Angeles, California

Jochen D. Muehlschlegel, M.D., M.M.Sc., Boston, Massachusetts

Paul S. Myles, M.B., B.S., M.P.H., M.D., Melbourne, Australia

Peter Nagele, M.D., M.Sc., Chicago, Illinois

Mark D. Neuman, M.D., M.Sc., Philadelphia, Pennsylvania

Craig Palmer, M.D., Tucson, Arizona

Alexander Proekt, M.D., Ph.D., Philadelphia, Pennsylvania

Cyril Rivat, M.D., Montpellier, France

Jeffrey Sall, M.D., Ph.D., San Francisco, California

Warren S. Sandberg, M.D., Ph.D., Nashville, Tennessee

Alan Jay Schwartz, M.D., M.S.Ed., Philadelphia, Pennsylvania

Daniel I. Sessler, M.D., Cleveland, Ohio

Allan F. Simpao, M.D., M.B.I., Philadelphia, Pennsylvania

Nikolaos J. Skubas, M.D., Cleveland, Ohio

ANESTHESIOLOGY

Trusted Evidence: Discovery to Practice®

The Official Journal of the American Society of Anesthesiologists anesthesiology.org

Mission: Promoting scientific discovery and knowledge in perioperative, critical care, and pain medicine to advance patient care.

Ken Solt, M.D., Boston, Massachusetts

David A. Story, M.B.B.S., B.Med.Sci., M.D., Parkville, Australia

Michel Struys, M.D., Ph.D., Groningen, The Netherlands

Eric Sun, M.D., Ph.D., Palo Alto, California

BobbieJean Sweitzer, M.D., Fairfax, Virginia

Marcos F. Vidal Melo, M.D., Ph.D., New York, New York

Jonathan P. Wanderer, M.D., M.Phil., Nashville, Tennessee

Duminda N. Wijesundera, M.D., Ph.D., Toronto, Canada

Hannah Wunsch, M.D., M.Sc., Toronto, Canada

Michael Zaugg, M.D., M.B.A., Edmonton, Canada

VISUAL TEAM

Christina Boncyk, M.D., Nashville, Tennessee

Holly B. Ende, M.D., Nashville, Tennessee

Julia Alejandra Gálvez Delgado, M.D., M.B.I., Omaha, Nebraska

Daniel Larach, M.D., Nashville, Tennessee

Olivia Nelson, M.D., Philadelphia, Pennsylvania

James P. Rathmell, M.D., Boston, Massachusetts

Allan F. Simpao, M.D., M.B.I., Philadelphia, Pennsylvania

Jonathan Tan, M.D., M.P.H., M.B.I., Los Angeles, California

Jonathan P. Wanderer, M.D., M.Phil., Nashville, Tennessee

Annemarie B. Johnson, Medical Illustrator, Winston-Salem,
North Carolina

Terri Navarette, Graphic Artist, Schaumburg, Illinois

AUDIO TEAM

Julia Alejandra Gálvez Delgado, M.D., M.B.I., Omaha, Nebraska

Young-Tae Jeon, M.D., Seoul, Korea

Yandong Jiang, M.D., Ph.D., Houston, Texas

Rie Kato, M.D., D. Phil., Kanagawa, Japan

James P. Rathmell, M.D., Boston, Massachusetts

Cyril Rivat, M.D., Montpellier, France

BobbieJean Sweitzer, M.D., Fairfax, Virginia

Henrique F. Vale, M.D., Jackson, Mississippi

SOCIAL MEDIA TEAM

Rita Agarwal, M.D., Palo Alto, California

Sean Barnes, M.B.A., M.D., Baltimore, Maryland

Gregory Bryson, M.D., B.Sc., M.Sc., Ottawa, Canada

Nabil Elkassabany, M.D., Philadelphia, Pennsylvania

Alana Flexman, M.D., Vancouver, Canada

Julia Alejandra Gálvez Delgado, M.D., M.B.I., Omaha, Nebraska

Harriet W. Hopf, M.D., Salt Lake City, Utah

Ruth Landau, M.D., New York City, New York

Edward R. Mariano, M.D., M.A.S., Palo Alto, California

Emily Sharpe, M.D., Rochester, Minnesota

Sasha Shillcutt, M.D., M.S., Lincoln, Nebraska

Caitlin Sutton, M.D., Houston, Texas

Allan F. Simpao, M.D., M.B.I., Philadelphia, Pennsylvania

Ankeet Udani, M.D., M.S.Ed., Durham, North Carolina