



ANESTHESIOLOGY

The Journal of the American Society of Anesthesiologists, Inc. • anesthesiology.org

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

EDITOR-IN-CHIEF

James C. Eisenach, M.D.
Editor-in-Chief, ANESTHESIOLOGY
Department of Anesthesiology
Wake Forest University School of Medicine
Medical Center Boulevard
Winston-Salem, NC 27157
Tel: (319) 356-4601
1-800-260-5631
E-mail: editorial-office@anesthesiology.org

PAST EDITORS-IN-CHIEF, ANESTHESIOLOGY

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

ANESTHESIOLOGY (ISSN 0003-3022) is published monthly by Lippincott Williams & Wilkins, 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116. Business office: Two Commerce Square, 2001 Market Street, Philadelphia, PA 19103. Periodicals postage paid at Hagerstown, MD, and at additional mailing offices. Copyright © 2011, the American Society of Anesthesiologists, Inc.

Annual Subscription Rates: *United States*—\$655 Individual, \$1086 Institution, \$256 In-training. *Rest of World*—\$675 Individual, \$1231 Institution, \$256 In-training. Single copy rate \$103. Subscriptions outside of North America must add \$50.60 for airfreight delivery. Add state sales tax, where applicable. The GST tax of 7% must be added to all orders shipped to Canada (Lippincott Williams & Wilkins' GST Identification #895524239, Publications Mail Agreement #1119672). Indicate in-training status and name of institution. Institution rates apply to libraries, hospitals, corporations, and partnerships of three or more individuals. Subscription prices outside the United States must be prepaid. Prices subject to change without notice. Subscriptions will begin with currently available issue unless otherwise requested. Visit us online at www.lww.com.

Individual and in-training subscription rates include print and access to the online version. Online-only subscriptions for individuals (\$199) and persons in training (\$55) are available to nonmembers and may be ordered by downloading a copy of the Online Subscription FAXback Form from the Web site, completing the information requested, and faxing the completed form to 301-223-2400/+44 (0) 20 7981 0535. Institutional rates are for print only; online subscriptions are available via Ovid. Institutions can choose to purchase a print and online subscription together for a discounted rate. Institutions that wish to purchase a print subscription, please contact Lippincott Williams & Wilkins, 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116; phone: 1-800-638-3030 (outside the United States 301-223-2300/+44 (0) 20 7981 0525); fax: 301-223-2400/+44 (0) 20 7981 0535. Institutions that wish to purchase an online subscription or online with print, please contact the Ovid Regional Sales Office near you or visit www.ovid.com/site/index.jsp and select Contact and Locations.

ASA OFFICERS

Mark Warner, M.D., President
Jerry Cohen, M.D., President-Elect
Alexander Hannenberg, M.D., Immediate Past President
John Zerwas, M.D., First Vice-President
Arnold Berry, M.D., Vice-President for Scientific Affairs

COVER ART

James P. Rathmell, M.D.
Boston, Massachusetts
Annemarie B. Johnson, C.M.I.
Winston-Salem, North Carolina
Tom Arcure
Winston-Salem, North Carolina

CME EDITORS

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

LWW PUBLICATION STAFF

Druanne Martin, Publisher
Joseph Albrecht, Journal Production Editor
Joanne Stato, Journal Production Associate
Christine Kenney, National Sales Manager, Advertising
Melissa Moody, Classified Advertising Representative

Address for non-member subscription information, orders, or change of address: Lippincott Williams & Wilkins, 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116; phone: 1-800-638-3030 (outside the United States 301-223-2300/+44 (0) 20 7981 0525); fax: 301-223-2400/+44 (0) 20 7981 0535; email: customerservice@lww.com. In Japan, contact LWW Japan Ltd., 3-23-14 Hongo, Bunkyo-ku, Tokyo 113, Japan; phone: 81-3-5689-5400; fax: 81-3-5689-5402; email: bclaim@lwwis.co.jp. In Bangladesh, India, Nepal, Pakistan, and Sri Lanka, contact Globe Publications Pvt. Ltd., B-13 3rd Floor, A Block, Shopping Complex, Naraina, Vihar, Ring Road, New Delhi 110028, India; phone: 91-11-25770411; fax: 91-11-25778876; email: info@globejpub.com.

Address for member subscription information, orders, or change of address: Members of the American Society of Anesthesiologists receive the print and online journal with their membership. To become a member or provide a change of address, please contact the American Society of Anesthesiologists, 520 N. Northwest Highway, Park Ridge, IL 60068-2573; phone: 847-825-5586; fax: 847-825-1692; email: membership@ASAhq.org. For all other membership inquiries, contact Lippincott Williams & Wilkins Customer Service Department, P.O. Box 1580, Hagerstown, MD 21741-1580; phone: 1-800-638-3030 (outside the United States 301-223-2300/+44 (0) 20 7981 0525); fax: 301-223-2400/+44 (0) 20 7981 0535; email: memberservice@lww.com.

Postmaster: Send address changes to ANESTHESIOLOGY, P.O. Box 1550, Hagerstown, MD 21740.

Advertising: Please contact Christine M. Kenney, National Sales Manager, Advertising, Lippincott Williams & Wilkins, 351 West Camden St, Baltimore, MD 21201; tel: (410) 528-4106, fax: (410) 558-6850, e-mail: Christine.Kenney@wolterskluwer.com. For classified advertising: Melissa Moody, Recruitment Advertising Representative, Lippincott Williams & Wilkins, 351 West Camden Street, Baltimore, MD 21201; tel: (410) 528-4098, (410) 558-6245, e-mail: Melissa.Moody@wolterskluwer.com.



ANESTHESIOLOGY

The Journal of the American Society of Anesthesiologists, Inc. • anesthesiology.org

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

EDITOR-IN-CHIEF

James C. Eisenach, M.D.
Winston-Salem, North Carolina

ASSISTANT EDITOR-IN-CHIEF

Timothy J. Brennan, Ph.D., M.D.
Iowa City, Iowa

STATISTICAL EDITOR

Timothy T. Houle, Ph.D.
Winston-Salem, North Carolina

WEB EDITOR

J. Lance Lichtor, M.D.
Worcester, Massachusetts

EDITORIAL OFFICE

George H. Kendall (Winston-Salem), Managing Editor
E-mail: managing-editor@anesthesiology.org
Vicky J. Farrington-Howrey (Iowa City)
Angel R. Marsh (Iowa City)
Shawn A. Platt (Iowa City)
ANESTHESIOLOGY Journal
Department of Anesthesia, 6546 JCP
The University of Iowa
200 Hawkins Drive
Iowa City, IA 52242-1009
Tel: (319) 356-4601; Fax (319) 353-6817
E-mail: editorial-office@anesthesiology.org

EDITORS

Michael J. Avram, Ph.D., Chicago, Illinois
Alain Borgeat, M.D., Zurich, Switzerland
Charles D. Collard, M.D., Houston, Texas
Hugh C. Hemmings, Jr., M.D., Ph.D., New York, New York
Shiroh Isono, M.D., Chiba, Japan
Judy R. Kersten, M.D., Milwaukee, Wisconsin
Eberhard F. Kochs, M.D., Munich, Germany
Bruno Riou, M.D., Ph.D., Paris, France

David S. Warner, M.D., Durham, North Carolina
Jeanine P. Wiener-Kronish, M.D., Boston, Massachusetts
William L. Young, M.D., San Francisco, California

ASSOCIATE EDITORS

Amr E. Abouleish, M.D., M.B.A., Galveston, Texas
Julien Amour, M.D., Ph.D., Paris, France
John Butterworth, M.D., Indianapolis, Indiana
Jaume Canet, M.D., Ph.D., Barcelona, Spain
Carol Wiley Cassella, M.D., Seattle, Washington
Frances Chung, M.D., Toronto, Canada
Andrew J. Davidson, M.D., M.B.B.S., F.A.N.Z.C.A., Melbourne, Australia
Stefan G. De Hert, M.D., Ph.D., Ghent, Belgium
Kenneth Drasner, M.D., San Francisco, California
Matthias Eikermann, M.D., Ph.D., Boston, Massachusetts
Nauder Faraday, M.D., Baltimore, Maryland
Pamela Flood, M.D., New York, New York
Kazuhiko Fukuda, M.D., Ph.D., Kyoto, Japan
Quinn H. Hogan, M.D., Milwaukee, Wisconsin
Brian P. Kavanagh, M.D., Toronto, Canada
Franz Kehl, M.D., Ph.D., D.E.A.A., Karlsruhe, Germany
Sachin Kheterpal, M.D., M.B.A., Ann Arbor, Michigan
J. Lance Lichtor, M.D., Worcester, Massachusetts
Jean Mantz, M.D., Ph.D., Clichy, France
David J. Murray, M.D., St. Louis, Missouri
Keiichi Omote, M.D., Sapporo, Japan
Piyush M. Patel, M.D., F.R.C.P.C., San Diego, California
Paolo Pelosi, M.D., Ph.D., Varese, Italy
James P. Rathmell, M.D., Boston, Massachusetts
David M. Roth, M.D., Ph.D., San Diego, California
Alan Jay Schwartz, M.D., M.S.Ed., Philadelphia, Pennsylvania
Daniel I. Sessler, M.D., Cleveland, Ohio
Jean-Louis Vincent, M.D., Ph.D., Brussels, Belgium
Zhiyi Zuo, M.D., Ph.D., Charlottesville, Virginia

Access to articles published in ANESTHESIOLOGY is available to nonsubscribers through pay-per-view at the journal Web site, www.anesthesiology.org. Authors may order quantity print or electronic reprints of their own articles using the order form supplied with their proofs and posted to the journal Web site. For all other bulk purchases, please contact reprintsolutions@wolterskluwer.com in North America, Carlos Moreyra (Carlos.Moreyra@wkglobal.com) in Latin America, and Jean Jones (PS-Reprints@wolterskluwer.com) in Europe and elsewhere.

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).

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).