

# AANA JOURNAL

Official Publication of the American Association of Nurse Anesthetists

## Editorial Committee

### Editor in Chief

Chuck Biddle, PhD, CRNA  
Richmond, Virginia

### Associate Editor

Lisa Osborne-Smith, PhD, MSN, CRNA,  
CAPT(ret), NC, USN  
Portland, Oregon

### Member

Michael P. Dosch, PhD, CRNA  
Grosse Pointe Park, Michigan

### Member

Cormac T. O'Sullivan, PhD, CRNA, ARNP  
Coralville, Iowa

### Member

COL Derrick C. Glymph, DNAP,  
CRNA, USAR  
Pembroke Pines, Florida

### Member

Monica Rose, PhD, MSN, BSN, CRNA  
Washington, D.C.

### Member

Mary Wojnakowski, PhD, MSN, CRNA  
Glendale, Arizona

---

## AANA Journal Reviewers

Paul N. Austin, PhD, CRNA  
Boyd's, Maryland

Margaret Faut Callahan, PhD,  
CRNA, FAAN  
Milwaukee, Wisconsin

Shawn Collins, DNP, PhD, CRNA  
Asheville, North Carolina

CDR Darren J. Couture, PhD,  
CRNA, NC, USN  
Poway, California

Joseph Cravero, MD  
Boston, Massachusetts

Mary Cushing, DNP, CRNA  
Bratenahl, Ohio

Matthew D'Angelo, DNP, CRNA  
Odenton, Maryland

Regina Daniels, CRNA  
Orange, Connecticut

Thomas Corey Davis, PhD, CRNA  
Glen Allen, Virginia

Brent Dunworth, DNP, MBA, CRNA, APRN  
Nashville, Tennessee

Sass Elisha, EdD, CRNA  
Huntington Beach, California

Christian R. Falyar, DNAP, CRNA  
Burlington, Iowa

James Furstein, PhD, DNAP, CRNA, CPNP-AC  
Cincinnati, Ohio

Rakesh Garg, MD, DNB, MNAMS, FCCS,  
PGCCHM  
Delhi, India

Bernadette Henrichs, PhD, CRNA, CCRN  
St. Louis, Missouri

Bruce Evan Koch, MSN, CRNA  
Spirit Lake, Idaho

Mark Kossick, DNSc, CRNA, APN  
Biltmore Lake, North Carolina

Michael J. Kremer, PhD, CRNA, FAAN  
Chicago, Illinois

LTC Robert Long, PhD, CRNA, ANC  
San Antonio, Texas

Rex A. Marley, MS, CRNA, RRT  
Fort Collins, Colorado

John P. Maye, PhD, CRNA, CAPT(ret),  
NC, USN  
Tampa, Florida

John J. Nagelhout, PhD, CRNA, FAAN  
Pasadena, California

John O'Donnell, DrPH, MSN, CRNA  
Pittsburgh, Pennsylvania

Joseph E. Pellegrini, PhD, CRNA, FAAN  
Woodstock, Maryland

Gwendolynn D. Randall, PhD, CRNA, ARNP  
Royal Palm Beach, Florida

Bruce A. Schoneboom, PhD, CRNA, FAAN,  
COL(ret), ANC, USA  
Baltimore, Maryland

Allan Schwartz, DDS, CRNA  
Columbia, Missouri

Dan Simonson, MHPA, CRNA  
Spokane, Washington

LTC Peter Strube, DNP, MSNA, CRNA,  
APNP, ARNP, ANC, USA  
Mount Horeb, Wisconsin

Judy Thompson, DNAP, CRNA, APRN  
Guilford, Connecticut

Tito D. Tubog, DNAP, CRNA, APRN,  
CCRN-CSC-CMC  
Arlington, Texas

Charles A. Vacchiano, PhD, CRNA  
Hillsborough, North Carolina

Maria Van Pelt, PhD, MS, CRNA  
Westborough, Massachusetts

Michael Vollman, PhD, RN  
Nashville, Tennessee

Mark D. Welliver, DNP, CRNA, ARNP  
Yulee, Florida

CDR Ken Wofford, PhD, CRNA,  
NC, USN  
Bethesda, Maryland

Suzanne M. Wright, PhD, CRNA  
Midlothian, Virginia

Sarah Jingying Zhang, PhD, CRNA  
Fremont, California

## Publication Staff

Larry Sawyer, BA  
Managing Editor

Sheryl Leonard, BFA  
Design/Production Associate

Christopher Bettin, MA  
Senior Director  
PR and Publications

**AANA Journal:** The AANA Journal, an official publication of the American Association of Nurse Anesthetists, is published bimonthly by the American Association of Nurse Anesthetists. It is the official scholarly journal of the AANA, publishing original manuscripts that foster our understanding of the science of anesthesia delivery and investigate issues, ideas, and innovations that advance the practice of nurse anesthesia.

Reproduction up to 250 words is allowed if the Journal is credited, but longer quotation requires written approval from the publisher. Copyright ©2018 American Association of Nurse Anesthetists. Material subject to this copyright appearing in the Journal may be photocopied for the noncommercial purpose of scientific or educational advancement.

**Information for Authors:** Author guidelines appear on the AANA website at: <http://www.aana.com/authors>. Submit editorial copy to Editorial Manager at <http://www.editorialmanager.com/aana>.

**Subscriptions:** The AANA Journal is available online to the public, free of charge, immediately upon publication of the print version. The print version is mailed to AANA members only. Retired AANA members wishing to receive the Journal or those requesting a single copy (\$45), should contact Karen Sutkus at [klsutkus@aana.com](mailto:klsutkus@aana.com) or 847-655-1140.

**Change of Address:** Update contact information online at [www.aana.com](http://www.aana.com) or contact Membership Manager Mary Alice Graf at [mgraf@aana.com](mailto:mgraf@aana.com).

**Advertising:** Contact: Sofia Goller, vice president, Sales & Marketing, [sgoller@healthcommedia.com](mailto:sgoller@healthcommedia.com). HCM – HealthCom Media, 215-489-7002. Media Planner: <http://www.aana.com/mediakit>

**Indexes:** The AANA Journal is indexed in the National Library of Medicine's MEDLINE database, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Copyright Clearance Center, EBSCOhost, ProQuest Information and Learning, and Elsevier's Embase, Scopus, and Mosby's Nursing Consult.

**Back Issues:** Back issues, in microfilm form, are available from National Archive Publishing Company, 300 N. Zeeb Road, Ann Arbor, MI 48103.

**Disclaimer:** The opinions expressed in the AANA Journal are those of the contributors and do not necessarily reflect the views of the American Association of Nurse Anesthetists, or their respective directors, officers, or staff.

**Post Office Information:** The AANA Journal (ISSN #0094-6354, USPS 283-260) is published bimonthly by the American Association of Nurse Anesthetists, 222 S. Prospect Ave., Park Ridge, IL 60068-4001. Periodical postage paid at Park Ridge, IL, and additional mailing offices. Postmaster send address changes to AANA Journal, 222 S. Prospect Ave., Park Ridge, IL 60068-4001. Canada Return Address (Canada Agreement No. 1956264): Email to [cpreturns@wdsml.com](mailto:cpreturns@wdsml.com) or mail to Station A, P.O. Box 54, Windsor, Ontario N9A 6J5.