

# INFECTION AND IMMUNITY

VOLUME 76 • JUNE 2008 • NUMBER 6

**Ferric C. Fang**, *Editor in Chief* (2012)  
*University of Washington School of Medicine*

**Andreas J. Bäuml**, *Editor* (2012)  
*University of California at Davis*

**Steven R. Blanke**, *Editor* (2012)  
*University of Illinois*

**James B. Bliska**, *Editor* (2008)  
*State University of New York, Stony Brook*

**Andrew Camilli**, *Editor* (2011)  
*Tufts University School of Medicine*

**Arturo Casadevall**, *Editor* (2010)  
*Albert Einstein College of Medicine*

**Victor J. DiRita**, *Editor* (2009)  
*University of Michigan Medical School*

**JoAnne L. Flynn**, *Editor* (2009)  
*University of Pittsburgh School of Medicine*

**James B. Kaper**, *Minireview Editor* (2008)  
*University of Maryland School of Medicine*

**Beth A. McCormick**, *Editor* (2012)  
*Massachusetts General Hospital and Harvard Medical School*

**Richard P. Morrison**, *Editor* (2010)  
*University of Arkansas for Medical Sciences*

**William A. Petri, Jr.**, *Editor* (2009)  
*University of Virginia School of Medicine*

**Joseph F. Urban, Jr.**, *Editor* (2008)  
*USDA Agricultural Research Service*

**Jeffrey N. Weiser**, *Editor* (2012)  
*University of Pennsylvania*

## EDITORIAL BOARD

David W. K. Acheson (2010)  
Luis Actis (2009)  
Rod Adam (2008)  
John H. Adams (2008)  
Tony Aebischer (2008)  
Darrin R. Akins (2009)  
Klaus Aktories (2008)  
John F. Alderete (2008)  
James Alexander (2010)  
Holly Algood (2010)  
Juan Anguita (2010)  
Rui Appelberg (2010)  
Judith A. Appleton (2009)  
Glen D. Armstrong (2010)  
Sandra K. Armstrong (2008)  
Ingo Autenrieth (2008)  
Abdu F. Azad (2008)  
Lauren Bakaletz (2010)  
Jimmy D. Ballard (2008)  
Jeff Banas (2010)  
Joseph Barbieri (2010)  
Peter F. Barnes (2009)  
Samuel M. Behar (2008)  
John Belisle (2010)  
Jorge A. Benitez (2010)  
Elke Bergmann-Leitner (2010)  
Luiz E. Bermudez (2009)  
Christian Bogdan (2009)  
Carolyn H. Bohach (2008)  
Gregory Bohach (2010)  
Subbarao Bondada (2008)  
Kenneth L. Bost (2009)  
Michael Brennan (2009)  
David Briles (2009)  
Wendy Brown (2010)  
Robert R. Brubaker (2008)  
Robert A. Burne (2008)  
Gerald Byrne (2009)  
Felipe C. Cabello (2010)  
Melissa J. Caimano (2009)  
Richard Calderone (2008)  
Joseph V. Califano (2009)  
Anthony A. Campagnari (2009)  
Michael Cappello (2010)  
James Carroll (2010)  
Kris Chadee (2008)  
John Chan (2009)  
Sandra P. Chang (2008)  
Ambrose Cheung (2008)  
Ashok K. Chopra (2009)  
Jeffrey D. Cirillo (2010)  
Steven Clegg (2008)  
Jennifer L. Coburn (2008)  
R. John Collier (2009)  
Carleen M. Collins (2010)  
Terry D. Connell (2009)  
Paul Converse (2010)  
Brad Cookson (2010)  
Cynthia Cornelissen (2009)  
Peggy Cotter (2009)  
Timothy L. Cover (2008)  
Christopher W. Cutler (2009)  
Steven J. Czinn (2008)  
Charles J. Czuprynski (2010)

Andrew Darwin (2009)  
George S. Deepe, Jr. (2010)  
Donald R. Demuth (2009)  
Eric Y. Denkers (2008)  
Dirk A. E. Dobbelaere (2010)  
Hazel Dockrell (2009)  
Mark Doherty (2010)  
Peter Dube (2008)  
Roman Dziarski (2008)  
Kathryn A. Eaton (2010)  
Stefan Ehlers (2009)  
Sabine Ehrt (2008)  
Karen Elkins (2010)  
David Elliott (2010)  
Masashi Emoto (2010)  
Joanne Engel (2009)  
Christian Engwerda (2010)  
Peter B. Ernst (2008)  
Marta Feldmesser (2010)  
J. Christopher Fenno (2009)  
Paul Fidel (2009)  
Ken Fields (2009)  
Timothy Foster (2010)  
Dara Frank (2010)  
Carl Frasch (2008)  
Nancy E. Freitag (2008)  
Matthias Frosch (2010)  
Francisco Garcia-del Portillo (2008)  
Nisha Garg (2010)  
Ricardo T. Gazzinelli (2010)  
Caroline Genco (2010)  
Frances D. Gillin (2010)  
Jorge A. Giron (2009)  
Michael Glickman (2010)  
Joanna B. Goldberg (2008)  
Kenneth J. Goodrum (2010)  
Bruce Green (2010)  
Patricia Guerry-Kopecko (2008)  
Paul A. Gulig (2008)  
John S. Gunn (2010)  
Carlos A. Guzman (2009)  
Constantine G. Haidaris (2010)  
Thomas L. Hale (2008)  
Emanuela Handman (2009)  
Eric J. Hansen (2010)  
Wolf-Dietrich Hardt (2010)  
Eric Harvill (2008)  
David Hasty (2010)  
Alan R. Hauser (2010)  
Edward A. Havell (2008)  
Jürgen Heesemann (2010)  
Robert Heinzen (2010)  
David Hendrixson (2010)  
Darren E. Higgins (2008)  
Sarah K. Highlander (2010)  
Eric Houpt (2009)  
Gary B. Huffnagle (2008)  
Christopher A. Hunter (2010)  
Christopher Huston (2010)  
Kris Huygen (2009)  
Lars Hviid (2009)  
Ann Jerse (2009)  
Bradley D. Jones (2008)  
Thomas H. Kawula (2010)

Beth D. Kirkpatrick (2010)  
Karl Klose (2008)  
Dennis J. Kopecko (2010)  
Eric Krukoni (2008)  
Sanjai Kumar (2010)  
Howard K. Kuramitsu (2008)  
Eric Lafontaine (2010)  
Richard J. Lamont (2010)  
David E. Lanar (2009)  
Chia Y. Lee (2010)  
John M. Leong (2009)  
Stuart Levitz (2008)  
David M. Lewinsohn (2008)  
Hank A. Lockman (2009)  
Jose L. Lopez-Ribot (2009)  
Douglas Lowrie (2008)  
Shirley Luckhart (2008)  
Adrian Luty (2010)  
David M. Lyerly (2009)  
Barbara J. Mann (2009)  
Richard T. Marconi (2008)  
Helene Marquis (2009)  
Carl F. Marrs (2008)  
Bruce A. McClane (2010)  
Dennis W. McGee (2008)  
John McKinney (2010)  
David N. McMurray (2009)  
D. Scott Merrell (2008)  
Karen Meysick (2008)  
F. Chris Minion (2009)  
Tim J. Mitchell (2009)  
Hans-Willi Mittrucker (2008)  
Harry L. T. Mobley (2010)  
Jeremy Mogridge (2010)  
Heidrun Moll (2008)  
Steven L. Moseley (2008)  
David M. Mosser (2009)  
Rodney A. Moxley (2010)  
Matthew Mulvey (2008)  
Robert S. Munson (2010)  
Moon H. Nahm (2008)  
Elizabeth Nardin (2009)  
James P. Nataro (2008)  
Gerard J. Nau (2008)  
Melody Neely (2009)  
Frank C. Nichols (2009)  
Karen A. Norris (2010)  
Steven J. Norris (2009)  
Joshua Nosanchuk (2010)  
Edwin V. Oaks (2008)  
Tom G. Obrig (2009)  
David O'Callaghan (2010)  
Joan C. Olson (2009)  
Mary O'Riordan (2009)  
Paul Orndorff (2010)  
Karen Ottemann (2010)  
Guy Palmer (2010)  
Vijay Pancholi (2009)  
David W. Pascual (2008)  
James C. Paton (2008)  
Shelley Payne (2010)  
Mario T. Philipp (2010)  
Carol Pickett (2008)  
Gerald B. Pier (2010)

Liise-anne Pirofski (2009)  
Gregory V. Plano (2010)  
Steven J. Projan (2008)  
Teresa Quitugua (2009)  
Lalita Ramakrishnan (2010)  
Roger G. Rank (2010)  
Rino Rappuoli (2008)  
Jörg Reimann (2010)  
Richard F. Rest (2008)  
Eleanor Riley (2010)  
Daniel Rockey (2010)  
Luigina Romani (2008)  
Roy Martin Roop II (2008)  
Craig R. Roy (2009)  
David Sacks (2008)  
Padmini Salgame (2008)  
James Samuel (2010)  
Matyas Sandor (2009)  
Charles Scanga (2010)  
Frank Scannapieco (2010)  
David Schauer (2010)  
Dieter M. Schifferli (2008)  
Larry S. Schlesinger (2009)  
Michael Schmitt (2009)  
Michael J. Schurr (2010)  
Ira Schwartz (2009)  
June R. Scott (2008)  
Jerry Simecka (2010)  
Upinder Singh (2008)  
Pamela Long Claus Small (2008)  
Mark Smeltzer (2009)  
Clifford M. Snapper (2009)  
Vanessa Sperandio (2009)  
Michael N. Starnbach (2008)  
Chad Steele (2010)  
Steffen Stenger (2009)  
Scott Stibitz (2009)  
Bradley Gene Stiles (2009)  
Susan C. Straley (2010)  
W. Edward Swords (2008)  
Carol O. Tacket (2010)  
Christopher Taylor (2010)  
Vernon Tesh (2008)  
John G. Tew (2010)  
Alfredo G. Torres (2009)  
Renee Tsoilis (2009)  
Elaine Tuomanen (2010)  
Joanne Turner (2008)  
Rodney K. Tweten (2008)  
Thomas E. Van Dyke (2010)  
Wesley C. Van Voorhis (2008)  
Michael L. Vasil (2008)  
Malabi M. Venkatesan (2009)  
Joseph M. Vinetz (2010)  
Joseph Vogel (2009)  
H. Martin Vordermeier (2009)  
Alison Weiss (2008)  
Rodney A. Welch (2008)  
Michael R. Wessels (2010)  
Lee M. Wetzler (2009)  
A. Clinton White, Jr. (2009)  
Brenda A. Wilson (2009)  
Mary Wilson (2010)  
Nathalie Winter (2009)

David O. Wood (2008)  
Donald Woods (2008)  
Jon Woods (2008)

John H. Wyckoff III (2009)  
Thomas A. Wynn (2010)  
George S. Yap (2009)

Hongwei Yu (2010)  
Ming H. Yuk (2009)  
Thomas C. Zahrt (2010)

Richard Zuerner (2010)  
Arturo Zychlinsky (2008)

---

Samuel Kaplan, *Chairman, Publications Board*      Barbara M. Goldman, *Director, Journals*  
Diane Smith, *Production Editor*      Stefanie Kowalski, *Assistant Production Editor*

---

*Infection and Immunity* (ISSN 0019-9567), a publication of the American Society for Microbiology (ASM), 1752 N St., N.W., Washington, DC 20036-2904, is devoted to the advancement and dissemination of fundamental knowledge concerning infections caused by pathogenic bacteria, fungi, and parasites. Instructions to authors are published in the January issue each year; reprints are available online and from the Journals Department. *Infection and Immunity* is published monthly, one volume per year. Nonmember print subscription prices (per year) are: \$900, U.S.; \$999, Canada (plus 6% GST, or 14% GST+HST where applicable); \$971, Europe; \$995, Latin America; \$998, rest of world. Member print subscription prices (per year) are: \$131, U.S.; \$230, Canada (plus 6% GST, or 14% GST+HST where applicable); \$202, Europe; \$226, Latin America; \$229, rest of world. Single copies are: \$100, nonmember; \$50, member (Canadians add 6% GST, or 14% GST+HST where applicable). For prices of electronic versions, contact the Subscriptions Unit, ASM. Correspondence relating to subscriptions, defective copies, missing issues, and availability of back issues should be directed to the Subscriptions Unit, ASM; correspondence relating to reprint orders should be directed to the Reprint Order Unit, ASM; and correspondence relating to disposition of submitted manuscripts, proofs, and general editorial matters should be directed to the Journals Department, American Society for Microbiology, 1752 N St., N.W., Washington, DC 20036-2904. Phone: (202) 737-3600.

Claims for missing issues from residents of the United States, Canada, and Mexico must be submitted within 3 months after publication of the issues; residents of all other countries must submit claims within 6 months of publication of the issues. Claims for issues missing because of failure to report an address change or for issues "missing from files" will not be allowed.

Periodicals postage paid at Washington, DC 20036, and at additional mailing offices.

POSTMASTER: Send address changes to *Infection and Immunity*, ASM, 1752 N St., N.W., Washington, DC 20036-2904.

Made in the United States of America. Printed on acid-free paper. doi:10.1128/IAI.76.6.2008 CODEN: INFIBR

Copyright © 2008, American Society for Microbiology. All Rights Reserved.

The code at the top of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal use or for personal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per-copy fee through the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, for copying beyond that permitted by Sections 107 and 108 of the U.S. Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.