

INFECTION AND IMMUNITY

VOLUME 66 • FEBRUARY 1998 • NUMBER 2

Vincent A. Fischetti, *Editor in Chief* (1999)
Rockefeller University

Joseph T. Barbieri, *Editor* (2001)
Medical College of Wisconsin

Janne G. Cannon, *Editor* (2001)
University of North Carolina

Stefan H. E. Kaufmann, *Editor* (1999)
Max Planck Institute for Infection Biology

Thomas R. Koziel, *Editor* (2000)
University of Nevada

John M. Mansfield, *Editor* (1998)
University of Wisconsin

Jerry R. McGhee, *Editor* (1999)
University of Alabama

Robert N. Moore, *Editor* (2001)
University of Tennessee

Paul E. Orndorff, *Editor* (1999)
North Carolina State University

Philippe J. Sansonetti, *Editor* (2002)
Institut Pasteur

Elaine I. Tuomanen, *Editor* (2002)
St. Jude Children's Research Hospital

EDITORIAL BOARD

David Acheson (1998)
Leslie G. Adams (1999)
Julia W. Albright (1998)
Judith E. Allen (1999)
Peter Andersen (1999)
Glen D. Armstrong (1998)
Sandra K. Armstrong (1999)
Ingo B. Autenrieth (2000)
Abdu F. Azad (1999)
Pamela J. Baker (2000)
Gregory J. Bancroft (1999)
Alan G. Barbour (1998)
Scott Barnum (1998)
Joel B. Baseman (2000)
Robert E. Baughn (1999)
Patrik Bavoil (1999)
Arnold Bayer (2000)
Kenneth W. Beagley (1999)
Blaine L. Beaman (2000)
Jorge L. Benach (1998)
William Benjamin (1998)
Luiz E. Bermudez (2000)
Lars Björck (2000)
Martin J. Blaser (1998)
Elisabetta Blasi (1999)
Ian Blomfield (1999)
Philip N. Bochsler (2000)
Christian Bogdan (2000)
Gregory A. Bohach (1999)
Kenneth L. Bost (2000)
Kim A. Brogden (2000)
Wendy Brown (2000)
Robert R. Brubaker (1999)
Donald E. Burgess (1998)
Drusilla L. Burns (2000)
Jerry Buysse (2000)
Gerald Byrne (2000)
Stephen Calderwood (2000)
Harlan D. Caldwell (1999)
Priscilla A. Campbell (1999)
Arturo Casadevall (1999)
Kris Chadee (1999)
W. LaJean Chaffin (2000)
John Chan (2000)
Singh Chatwal (2000)
Ambrose Cheung (1999)
Noel K. Childers (2000)
Nicholas P. Cianciotto (1999)
Josephine Clark-Curtiss (1999)
P. Patrick Cleary (1999)
Steven Clegg (1999)
Daniel Clements (1999)
John D. Clements (1998)
R. John Collier (2000)
Carleen Collins (2000)
Frank M. Collins (1998)
Terry D. Connell (2000)

Cynthia Cornelissen (2000)
Rebecca A. Cox (1999)
Allan W. Cripps (1999)
Madeleine Cunningham (2000)
Melanie T. Cushion (1999)
Christopher W. Cutler (2000)
Jim E. Cutler (1999)
Cecil Czerkinsky (1998)
Steven J. Czinn (1999)
Charles J. Czuprynski (1998)
Patrick De Baetselier (1998)
George S. Deepe, Jr. (1998)
Eric Y. Denkers (1999)
Bob Deresiewicz (2000)
Victor DiRita (1999)
Dirk A. E. Dobbelaere (1998)
Judith E. Domer (1998)
Michael S. Donnenberg (1999)
David W. Dyer (2000)
Roman Dziarski (1999)
Kathryn Edwards (1998) (2000)
Stefan Ehlers (2000)
Toby K. Eisenstein (1999)
Karen Elkins (1999)
N. Cary Engleberg (1998)
David M. Engman (2000)
Peter B. Ernst (1999)
Joseph J. Ferretti (1998)
Barry Fields (1999)
Brett B. Finlay (1999)
Joanne L. Flynn (1999)
William A. Fonzi (2000)
Anne H. Fortier (1999)
Dara W. Frank (2000)
David O. Freeman (2000)
Kohtarō Fujihashi (2000)
Jorge E. Galán (1999)
Caroline Attardo Genco (1999)
Francis Ghiotti (2000)
Frances D. Gillin (1998)
Mae F. Go (1999)
Werner Goebel (1998)
Joanna B. Goldberg (1999)
William E. Goldman (1998)
Emil Gotschlich (2000)
David P. Greenberg (1998)
Brian Greenwood (1999)
Patricia Guerry-Kopecko (1999)
Paul A. Gulig (1999)
Carlos A. Guzman (2000)
Jörg Hacker (1998)
Constantine G. Haidaris (1998)
Thomas L. Hale (1999)
Jane L. Halpern (1999)
Shigeyuki Hamada (1999)
Philip C. Hanna (1999)
Eric J. Hansen (1998)

David L. Hasty (2000)
Edward A. Havell (1999)
Richard F. Hectar (1998)
Jürgen Heesemann (1998)
Fred Heffron (1999)
Jürgen Hess (1998)
Erik Hewlett (1999)
Harry R. Hill (1999)
Takachika Hiroi (1999)
Anthony A. Holder (1999)
Edward W. Hook (1999)
Christopher A. Hunter (1998)
Kris Huygen (2000)
Ralph R. Isberg (1999)
Juraj Ivaný (1999)
Matt Jackson (1998)
Thomas R. Jerrrells (1999)
Ann Jerse (2000)
Bradley D. Jones (2000)
Dieter Kabelitz (1998)
James B. Kaper (2000)
David Kaslow (1999)
Lloyd H. Kasper (2000)
Thomas H. Kawula (1998)
Paul M. Kaye (2000)
James W. Kazura (2000)
Peter Kern (2000)
Mogens Kilian (1999)
Theo N. Kirkland (1998)
Hiroshi Kiyono (1998)
Thomas R. Klei (1999)
Bruce S. Klein (1999)
Toshihiko Koga (1998)
Michael Koomey (2000)
Dennis J. Kopecko (1998)
Malak Koth (2000)
J. P. Kraehenbuhl (1999)
Agnes F. Labigne (1998)
David E. Lanar (2000)
Marilyn S. Lantz (2000)
Catherine Anne Lee (1999)
David Leiby (1998)
John M. Leong (2000)
Myron Levine (2000)
Stuart Levitz (1999)
Stephen J. Libby (2000)
Philip T. LoVerde (2000)
Douglas Lowrie (1999)
Carl F. Marrs (1999)
Kouji Matsuhashima (1998)
Anthony Maurelli (1999)
Bruce A. McClane (1998)
Dennis W. McGee (1999)
David N. McMurray (2000)
John Mekalanos (1998)
Eleanor S. Metcalf (1998)
Thomas F. Meyer (1998)

Martin Mielke (1998)
Christopher Miller (2000)
Samuel I. Miller (2000)
Virginia L. Miller (1999)
Michael L. Mifeldt (2000)
Harry L. T. Mobley (1998)
Robert L. Modlin (1998)
J. Glenn Morris, Jr. (1999)
Steven L. Moseley (1999)
Rodney Moxley (1998)
Grace Mulcahy (1999)
Ingrid Muller (2000)
Robert S. Munson (1998)
Juneann W. Murphy (1999)
Daniel M. Musher (1998)
Moon H. Nahm (1999)
James P. Nataro (1999)
John Nedrud (1999)
Chris Newbold (1999)
Thalia I. Nicas (1998)
Karen A. Norris (1998)
Steven J. Norris (2000)
Robert North (1998)
Bogdan Nowicki (1998)
Andreas K. Nussler (2000)
Tom G. Obrig (2000)
Ian M. Orme (1999)
Eric Oswald (1998)
Michael J. Parmely (1998)
Jeffrey Parsonnet (1999)
David W. Pascual (1999)
James C. Paton (1999)
Shelley M. Payne (2000)
Edward J. Pearce (1998)
Miércio E. A. Pereira (1999)
Robert D. Perry (1998)
Kenneth M. Peterson (1999)
Carol Pickett (1999)
Gerald B. Pier (1998)
Dorothy Pierson (2000)
Matthew Pollack (1999)
David Portnoy (1998)
Daniel A. Portnoy (1998)
Myron Levine (2000)
Stuart Levitz (1999)
Stephen J. Libby (2000)
Philip T. LoVerde (2000)
Douglas Lowrie (1999)
Carl F. Marrs (1999)
Neil E. Reiner (2000)
Errol Reiss (2000)
Richard F. Rest (1999)
Judith C. Rhodes (1998)
Ernst T. Rietschel (1998)
Eleanor M. Riley (2000)
Mark Roberts (1999)
Luigina Romani (1999)

Roy Martin Roop II (1999)
Sara W. Rothman (1999)
Craig E. Rubens (2000)
David G. Russell (1999)
Roy R. B. Russell (1998)
Alan Sacks (1999)
James Samuel (1998)
David Schauer (1998)
Dieter M. Schifferli (1999)
June R. Scott (1999)
Alan Sher (1998)
Richard Silverstein (1998)
Jerry Simecka (2000)
Emil Skamene (2000)
Jonathan T. Skare (1999)
Werner Solbach (2000)
Herman F. Staats (1999)
Samuel L. Stanley, Jr. (2000)
Mary Stevenson (2000)
Scott Stibitz (2000)
Susan C. Straley (1998)
Paul Sullam (1999)
Catharina Svanborg (1999)
Bogdan Nowicki (1998)
Ichiro Takahashi (1999)
Tae Takada (1999)
Rick Tarleton (2000)
Diane Wallace Taylor (1999)
Vernon Tesh (1999)
John G. Tew (1998)
Cindy Theodos (1999)
James Travis (2000)
Rodney K. Tweten (1999)
Joseph F. Urban, Jr. (1999)
Miércio E. A. Pereira (1999)
Ivo van de Rijn (1999)
Thomas E. Van Dyke (1998)
Michael L. Vasil (1999)
David Walker (2000)
Leigh R. Washburn (1998)
Alison Weiss (1999)
Reuven Porat (1998)
Rodney A. Welch (1999)
Susan E. H. West (1998)
Theodore C. White (2000)
Brenda A. Wilson (2000)
Mark E. Wilson (2000)
Herbert L. Winkler (1998)
Kim S. Wise (1998)
Jon Woods (1999)
John H. Wyckoff III (2000)
Thomas A. Wynn (1998)
Douglas B. Young (2000)
Lowell Young (2000)
Fidel Zavala (2000)
Arturo Zychlinsky (1999)

Barbara H. Iglewski, *Chairman, Publications Board*
Diane Smith, *Production Editor*

Linda M. Illig, *Director, Journals*
Karen MacKavanagh, *Assistant Production Editor*

Infection and Immunity (ISSN 0019-9567), a publication of the American Society for Microbiology (ASM), 1325 Massachusetts Ave., N.W., Washington, DC 20005-4171, 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 from the editors and the Journals Department. *Infection and Immunity* is published monthly, one volume per year. Nonmember print subscription prices (per year) are: \$436, U.S.; \$448, Canada (plus 7% GST, or 7% GST + 8% HST where applicable); \$481, Europe; \$485, Latin America; \$492, rest of world. Member print subscription prices (per year) are: \$63, U.S.; \$75, Canada (plus 7% GST, or 7% GST + 8% HST where applicable); \$119, Europe; \$124, Latin America; \$131, rest of world. Single copies are: \$47, nonmember, \$15, member (Canadians add 7% GST, or 7% GST + 8% HST where applicable). For prices of CD-ROM 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, 1325 Massachusetts Ave., N.W., Washington, DC 20005-4171. 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 20005, and at additional mailing offices.

POSTMASTER: Send address changes to *Infection and Immunity*, ASM, 1325 Massachusetts Ave., N.W., Washington, DC 20005-4171.

Copyright © 1998, American Society for Microbiology. All Rights Reserved. Made in the United States of America. Printed on acid-free paper. CODEN: INFIBR
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.