

# THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

Founded 1908

Incorporated 1915

## The APS Council

President, O. W. BARNETT, Clemson University, Clemson, SC 29631  
President-Elect, RANDALL C. ROWE, Ohio State University, Wooster 44691  
Vice President, CLEORA J. D'ARCY, University of Illinois, Urbana 61801  
Immediate Past President, GEORGE N. AGRIOS, University of Florida, Gainesville 32611  
Secretary, MOLLY N. CLINE, Monsanto Agricultural Co., St. Louis, MO 63167  
Treasurer, STANLEY P. PENNYPACKER, Pennsylvania State University, University Park 16802  
Editor-in-Chief, APS Press, STEVEN A. SLACK, Cornell University, Ithaca, NY 14853-5908  
Editor-in-Chief, PHYTOPATHOLOGY, LAURENCE V. MADDEN, Ohio State University, Wooster 44691  
Editor-in-Chief, PLANT DISEASE, WAYNE L. PEDERSEN, University of Illinois, Urbana 61801  
Editor-in-Chief, MOLECULAR PLANT-MICROBE INTERACTIONS, FRED AUSUBEL, Harvard Medical School, Boston, MA 02114

## Councilors:

SUE A. TOLIN, Virginia Polytechnic Institute and State University, Blacksburg 24061 (At Large)  
CAROL E. WINDELS, University of Minnesota, Crookston 56716 (At Large)  
MARY L. POWELSON, Oregon State University, Corvallis 97331-2902 (At Large)  
JOSE AMADOR, Texas Agricultural Extension Service, Weslaco 78596 (Caribbean)  
ALBERT H. ELLINGBOE, University of Wisconsin, Madison 53706 (North Central)  
KENNETH D. HICKEY, Pennsylvania State University, Biglerville 17307 (Northeastern)  
ROBERT K. WEBSTER, University of California, Davis 95616 (Pacific)  
WILLIAM L. MacDONALD, West Virginia University, Morgantown 26506-6057 (Potomac)  
KENNETH E. CONWAY, Oklahoma State University, Stillwater 74078-9947 (Southern)

## Staff:

STEVEN C. NELSON, Executive Vice President  
MILES WIMER, Director of Publications; LARRY HARTMAN, Director of Finance and Administration  
The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121-2097

## Divisions of the Society

**Caribbean:** President, CONRADO DABOIN, U.S.L.A., Barquisimeto, Venezuela; Vice President, JOSE MARIA GARCIA, El Salvador; Secretary-Treasurer, JOSE J. GALINDO, CATIE, Turrialba, Costa Rica  
**North Central:** President, STEVEN M. RIES, University of Illinois, Urbana 61801; Vice President, BERLIN NELSON, North Dakota State University, Fargo 58105; Secretary-Treasurer, DOUGLAS J. JARDINE, Kansas State University, Manhattan 66506  
**Northeastern:** President, DAVID R. HOUSTON, USDA Forest Service, Hamden, CT 06514; Vice President, GEORGE S. ABAWI, Cornell University, Geneva, NY 14456; Secretary-Treasurer, SHARON M. DOUGLAS, Connecticut Agricultural Experiment Station, New Haven, CT 06504  
**Pacific:** President, GARY A CHASTAGNER, Washington State University, Puyallup 98371; Vice President, STELLA M. COAKLEY, Oregon State University, Corvallis 97331-2902; Secretary-Treasurer, JOYCE E. LOPER, USDA-ARS, Corvallis, OR 97330  
**Potomac:** President, KENNETH L. DEAHL, USDA-ARS, Beltsville, MD 20705; Vice President, THOMAS A. EVANS, University of Delaware, Georgetown 19947; Secretary-Treasurer, ARVYDAS GRYBAUSKAS, University of Maryland, College Park 20742  
**Southern:** President, DONALD R. SUMNER, Coastal Plain Experiment Station, Tifton, GA 31793; Vice President, E. I. ZEHR, Clemson University, Clemson, SC 29634-0377; Secretary-Treasurer, MARVIN E. MILLER, Texas Agricultural Experiment Station, Weslaco 78596

## Editorial and Business Staff

Publisher and Business Manager, STEVEN C. NELSON; Director of Publications, MILES WIMER; Editorial Supervisor, JEAN RICE; Technical Editors, MOIRA PALUMBO and JULIE PABST; Assistant Editor, SUSAN CASEY; Editorial Records Coordinator, JANICE SAMPSON; Production Manager, STEVE KRONMILLER; Circulation Coordinator, CAROL PAGEL

**Subscriptions:** Communications should be addressed to The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121-2097. **Nonmember subscription price:** \$225.00 per year domestic, \$260.00 per year elsewhere (including Canada and Mexico). Canadian GST #R 129888129. All prices include surface postage. For expedited mail, add \$25.00 to the "elsewhere" price. All payments must be made in U.S. funds, through a member bank of the U.S. Federal Reserve System. **Single current numbers** (within 60 days of publication): \$21.00. (Price of back volumes and separate numbers on request.) **Airmail rates for delivery outside of North America quoted on request.** Claims for copies lost in domestic mails must be received within 60 days of the date of issue; otherwise the replacement charge will be \$21.00. Deliveries overseas are not guaranteed; foreign mailings are made at the subscriber's risk. No endorsement or any statement of claims made in advertisements is assumed by this journal or by The American Phytopathological Society.

**Membership in The American Phytopathological Society:** Information concerning membership in The American Phytopathological Society and special publication rates for members are available from the business office of the Society.

**PHYTOPATHOLOGY (ISSN 0331-949X)** is published monthly at The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121-2097 ([612] 454-7250). Second class postage paid at St. Paul, MN. USPS 431-540. **POSTMASTER: Send address changes to PHYTOPATHOLOGY, 3340 Pilot Knob Road, St. Paul, MN 55121-2097.**

# Phytopathology

## Editorial Board

### Editor-in-Chief:

L. V. MADDEN, Ohio State University, Wooster 44691

### Senior Editors:

D. C. GROSS, Washington State University, Pullman 99164

D. S. MARSHALL, Texas A&M University, Dallas 75252

J. W. MOYER, North Carolina State University, Raleigh 27695-7616

M. L. POWELSON, Oregon State University, Corvallis 97331

R. C. SEEM, Cornell University, Geneva, NY 14456

S. R. SHAFER, USDA-ARS, North Carolina State University, Raleigh 27606

### Associate Editors

C. L. BENDER, Oklahoma State University, Stillwater 74078

K. L. BOWEN, Auburn University, Auburn, AL 36849

M. E. DAUB, North Carolina State University, Raleigh 27695

A. E. DESJARDINS, USDA-ARS, Peoria, IL 61603

M. C. EDWARDS, USDA-ARS, Fargo, ND 58105

B. W. FALK, University of California, Davis 95616

D. R. FRAVEL, USDA-ARS, Beltsville, MD 20705

T. R. GOTTWALD, USDA-ARS, Orlando, FL 32803

G. G. GROVE, Washington State University, Wenatchee 98801

N. C. GUDMESTAD, North Dakota State University, Fargo 58105

M. C. HEATH, University of Toronto, Ontario, Canada M5S 3B2

L. J. HERR, Ohio State University, Wooster 44691

A. D. HEWINGS, USDA-ARS, Urbana, IL 61801

H.-T. HSU, USDA-ARS, Beltsville, MD 20705

S. W. HUTCHESON, University of Maryland, College Park 20742

D. A. KLUEPFEL, Clemson University, Clemson, SC 29634

W. KÖLLER, Cornell University, Geneva, NY 14456

J. A. KOLMER, Agriculture Canada, Winnipeg, Ontario, Canada R3T 2M9

C. M. KENERLEY, Texas A&M University, College Station 77843

J. M. KRUPINSKY, Northern Great Plains Research Center, Mandan, ND 58554

B. A. McDONALD, Texas A&M University, College Station 77843

F. W. NUTTER, JR., Iowa State University, Ames 50011

R. P. SINGH, CIMMYT, Mexico DF, Mexico 06600

T. C. PAULITZ, MacDonald College, St. Anne de Bellevue, Quebec, Canada H9X 1C0

G. A. PAYNE, North Carolina State University, Raleigh, NC 27695

C. M. RUSH, Texas Agricultural Experiment Station, Bushland, TX 79012

R. P. SINGH, Agriculture Canada, Fredrickton, New Brunswick E3B 4Z7

B. J. STEFFENSON, North Dakota State University, Fargo 58105

L. W. TIMMER, University of Florida, Lake Alfred 33850

C. H. WALKINSHAW, USDA Forest Service, Pineville, LA 71361

D. M. WELLER, USDA-ARS, Pullman 99164

J. P. WILSON, USDA-ARS, Tifton, GA 31793

### General Publication Policies

Manuscripts may be submitted for consideration of publication in *PHYTOPATHOLOGY* by members of The American Phytopathological Society and by nonmembers. Membership in the Society is not a prerequisite for publication in the journal, but page charges are higher for nonmembers than for members.

**Submission of manuscripts:** Submit all new manuscripts (two copies plus one set of original figures) to The American Phytopathological Society, Editorial Office, 3340 Pilot Knob Road, St. Paul, MN 55121-2097. Do not submit new manuscripts to the Editor-in-Chief. Submission implies nonsubmission elsewhere and (if accepted) no publication elsewhere in the same form without consent. Virology manuscripts may be sent directly to senior editor J. W. Moyer, Department of Plant Pathology, North Carolina State University, Box 7616, Raleigh, NC 27695-7616. In the latter case, send three copies of the manuscript.

**Content:** Contributions should fall into the following categories: 1) Original research on some aspect of plant pathology. Subject matter is not a criterion for judging the merit of an article for publication in *PHYTOPATHOLOGY*. It is, however, the author's duty to establish relevancy to the science of plant pathology. 2) Obituaries. 3) Letters to the Editor: These may explain, amplify, or otherwise comment upon research published in the journal or elsewhere. Letters to the editor are reviewed in the same manner as other contributions, and the Editorial Board reserves the right to reject or to publish letters of rebuttal when appropriate. If possible, the opportunity will be provided for a letter of rebuttal to appear in the same issue as the letter to which it is directed.

The emphasis in *PHYTOPATHOLOGY* is on research that advances understanding of the nature of plant diseases, their spread, the losses they cause, and measures that can be used to control them. Acceptance depends on the originality of the work, soundness of organization of the manuscript, reliability of the methods in terms of their adequacy to support the conclusions, clarity of presentation, validity of the reasoning in deriving the conclusions, and the possibility of alternative interpretations. Authors should display an awareness of previously published information on the same subject and relate their findings to it. Appropriate statistical analyses should be included. In general, an article in which conclusions are based on unreplicated experiments is unacceptable.

**Page charges:** Because of the high cost of publishing articles in *PHYTOPATHOLOGY*, payment of page charges is mandatory. Page charges are subject to change and will not be finalized until the author receives galley proofs. Current charges are \$80 per printed page for members of The American Phytopathological Society and \$130 per printed page for nonmembers, plus \$15 per halftone or composite illustration. Manuscripts not submitted for final processing on computer diskette are subject to a \$50 per article surcharge to cover the costs of copy input. The author is billed after the article is printed in the journal.

**Separates:** No free copies supplied. Reprints are available to authors at a nominal cost; an order form will be provided and must be returned with the proof.

**For style details, follow:** Author's Guide for Manuscript Preparation, *PHYTOPATHOLOGY* 82:4-6, 1992. Authors are urged to have one or more colleagues read the manuscript *critically* prior to submission.

**Use of material from this journal:** *PHYTOPATHOLOGY* is copyrighted, and those who wish to use illustrations or data appearing in *PHYTOPATHOLOGY* in other publications should obtain the permission from The American Phytopathological Society and the author of the paper and provide a line crediting *PHYTOPATHOLOGY* as the source of the material.

Authorization to photocopy copyrighted material for internal or personal use, or the internal or personal use of specific clients, is granted by The American Phytopathological Society for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$3.00 per copy of an article is paid directly to CCC, 21 Congress St., Salem, MA 01970. 0031-949X/92 \$3.00 + .00