

**EDITOR**

Jagdev M. Sharma  
College of Veterinary Medicine  
University of Minnesota  
St. Paul, Minnesota 55108

**BUSINESS MANAGER**

Charles L. Hofacre  
University of Georgia  
953 College Station Road  
Athens, Georgia 30602-4875

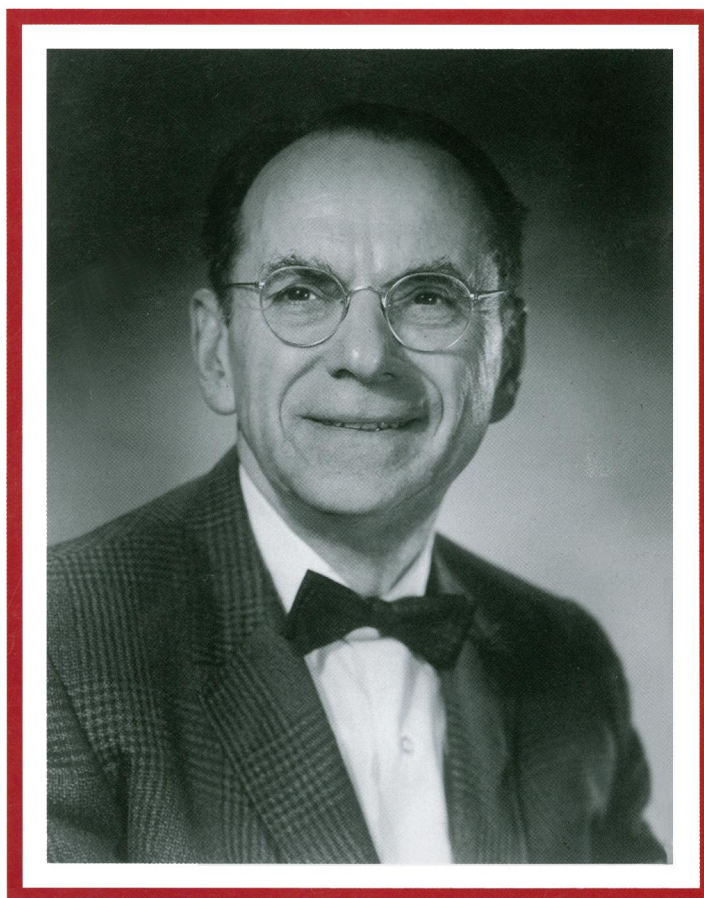
**EDITORIAL BOARD**

A. J. Bermudez  
T. P. Brown  
C. J. Cardona  
H. D. Chapman  
R. P. Chin  
S. Davison  
A. M. Fadly  
O. J. Fletcher  
R. K. Gast  
J. S. Guy  
F. J. Hoerr  
D. J. Jackwood  
M. W. Jackwood  
D. R. Kapczynski  
C. L. Keeler  
D. J. King  
S. H. Kleven  
M. Lee  
H. S. Lillehoj  
J. Maurer  
L. R. McDougald  
R. D. Montgomery  
T. Morishita  
M. K. Njenga  
L. Nolan  
M. S. Parcells  
S. Rautenschlein  
S. Reddy  
D. L. Reynolds  
Y. M. Saif  
K. A. Schat  
J. Schrader  
B. Seal  
D. Senne  
H. L. Shivaprasad  
R. F. Silva  
R. Singer  
D. L. Suarez  
D. E. Swayne  
J.-P. Vaillancourt  
P. Villegas  
P. S. Wakenell  
E. Wallner-Pendleton  
P. R. Woolcock  
C. C. Wu

# *Avian Diseases*

**An international journal dedicated to avian health**

Published Quarterly by  
The American Association of Avian Pathologists



**Vol. 49 No. 1**

**March 2005**

**Pages 1-176**

# Avian Diseases

Published by the American Association of Avian Pathologists

Visit the AAAP at [www.aaap.info](http://www.aaap.info).

## MISSION

*Avian Diseases is an international journal dedicated to publishing original basic or clinical research of the highest quality from various disciplines including microbiology, immunology, and pathology. Papers on avian diseases relevant to etiology, pathogenesis, diagnosis, treatment, and control are accepted. The mission is to enhance scientific knowledge and promote avian health.*

## EDITOR

**Jagdev M. Sharma**

College of Veterinary Medicine  
University of Minnesota  
1971 Commonwealth Avenue  
St. Paul, Minnesota 55108  
[avian.diseases@umn.edu](mailto:avian.diseases@umn.edu)  
Telephone: 612-624-5773  
Fax: 612-624-5608

## AVIAN DISEASES ADVISORY BOARD

**Dr. Carol J. Cardona**

University of California  
[cjcardona@ucdavis.edu](mailto:cjcardona@ucdavis.edu)

**Dr. Oscar J. Fletcher**

North Carolina State University  
[Oscar\\_fletcher@ncsu.edu](mailto:Oscar_fletcher@ncsu.edu)

**Dr. Richard C. Jones**

University of Liverpool (UK)  
[r.c.jones@liverpool.ac.uk](mailto:r.c.jones@liverpool.ac.uk)

**Dr. Mark S. Parcels**

University of Delaware  
[Parcells@udel.edu](mailto:Parcells@udel.edu)

**Dr. John A. Smith**

Fieldale Farms Corp.  
[johnsmith@fieldale.com](mailto:johnsmith@fieldale.com)

*AVIAN DISEASES* IS PUBLISHED FOUR TIMES A YEAR AT UNIVERSITY OF GEORGIA, ATHENS, GEORGIA, BY THE AMERICAN ASSOCIATION OF AVIAN PATHOLOGISTS, INC. (ISSN 0005-2086) Subscriptions in the U.S. territories and possessions thereof, \$160.00 a year. For all other subscriptions, \$195.00 a year (including Allen Air). Checks should be made payable to "AAAP." Send to AAAP, 953 College Station Road, Athens, GA 30602-4875. Subscription rates are subject to change without notice.

**Postmaster: please address corrections to address noted above.**

Periodicals postage paid at Athens, Georgia, and at additional mailing offices.

## DISCLAIMER

No endorsements are implied herein, nor does mention of a chemical imply registration.

## AUTHORS

Prospective authors should consult "Guidelines for Authors," which follows the final paper in this issue.

∞ **This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).**

Photo on the cover: Dr. P.P. Levine, 1907–1979. Founder and first editor of *Avian Diseases*. The first issue of the journal was published in May 1957. Dr. Levine's photo was provided by the College of Veterinary Medicine, Cornell University, NY where he received his D.V.M. and Ph.D. degrees and spent most of his professional career.