Microscopy and Microanalysis

An International Journal for the Biological and Physical Sciences

THE OFFICIAL JOURNAL OF

MICROSCOPY SOCIETY OF AMERICA
MICROBEAM ANALYSIS SOCIETY
MICROSCOPICAL SOCIETY OF CANADA /
SOCIÉTÉ DE MICROSCOPIE DU CANADA
MEXICAN MICROSCOPY SOCIETY
BRAZILIAN SOCIETY FOR MICROSCOPY AND MICROANALYSIS
VENEZUELAN SOCIETY OF ELECTRON MICROSCOPY
EUROPEAN MICROBEAM ANALYSIS SOCIETY
AUSTRALIAN MICROSCOPY AND MICROANALYSIS SOCIETY
PORTUGUESE SOCIETY FOR MICROSCOPY

PUBLISHED IN AFFILIATION WITH

ROYAL MICROSCOPICAL SOCIETY
GERMAN SOCIETY FOR ELECTRON MICROSCOPY
BELGIAN SOCIETY FOR MICROSCOPY
MICROSCOPY SOCIETY OF SOUTHERN AFRICA

Editor in Chief Editor, Biological Applications

Robert L. Price
Department of Cell and Developmental
Biology and Anatomy
School of Medicine
University of South Carolina
6439 Garner's Ferry Road, Bldg. 1 B-60
Columbia, SC 29209
Phone: (803) 733-3392

Phone: (803) 733-3392 Fax: (803) 733-3212

e-mail: Bob.Price@uscmed.sc.edu

Editor, Materials Applications

David J. Smith
Department of Physics
School of Materials
Arizona State University
Tempe, Arizona 85287-1504
Phone: (480) 965-4540
Fax: (480) 965-9004
e-mail: david.smith@asu.edu

Editor, Materials Applications

Elizabeth Dickey Materials Science and Engineering Pennsylvania State University 223 MRL Building University Park, PA 16802-7003 Phone: (814) 865-9067

Fax: (814) 863-8561

e-mail: ecd10@psu.edu

Editor, Light and Scanning Probe Microscopies

Brian Herman Cellular and Structural Biology University of Texas at San Antonio 7703 Floyd Curl Drive San Antonio, Texas 78284-7762 Phone: (210) 567-3800 Fax: (210) 567-3803 e-mail: hermanb@uthscsa.edu

Editor, Biological Applications

Heide Schatten Veterinary Pathobiology University of Missouri-Columbia 1600 E. Rollins Street Columbia, Missouri 65211-5030 Phone: (573) 882-2396 Fax: (573) 884-5414 e-mail: schattenh@missouri.edu

Editor, Microanalysis

John Mansfield Electron Microbeam Analysis Lab North Campus, 417 SRB University of Michigan 2455 Hayward Ann Arbor, MI 48109-2143 Phone: (734) 936-3352 Fax: (734) 763-2282

e-mail: jfmjfm@umich.edu

Special Issues and Reviews Editor

Jay Jerome Vanderbilt University Medical Center Nashville, TN 37232 e-mail: jay.jerome@vanderbilt.edu

Book Review Editor

Cynthia S. Goldsmith Centers for Disease Control Atlanta, GA 30333 e-mail: csg1@cdc.gov

Calendar Editor

Nan Yao Princeton University Princeton, NJ 08540 e-mail: nyao@Princeton.edu

Expo Editor

Richard E. Edelmann Miami University Oxford, OH 45056 e-mail: edelmare@muohio.edu

Proceedings Editor

John Shields University of Georgia Athens, GA 30602 e-mail: jshields@cb.uga.edu

Editorial Board

Ralph Albrecht
University of Wisconsin, Madison, Wisconsin
Barry Carter
University of Connecticut, Storrs, Connecticut
Wah Chiu
Baylor College of Medicine, Houston, Texas
Alwyn Eades
Lehigh University, Bethlehem, Pennsylvania

Mark Ellisman University of California at San Diego, San Diego, California

Pratibha Gai University of York, United Kingdom

Marija Gajdardziska-Josifovska University of Wisconsin-Milwaukee, Milwaukee, Wisconsin

Dale Johnson University of South Florida, Tampa, Florida
Paul Kotula Sandia National Labs, Albuquerque, New Mexico

William Landis Northeastern Ohio Universities College of Medicine, Rootstown, Ohio

Eric Lifshin

SUNY at Albany, Albany, New York

Charles Lyman

Lehigh University, Bethlehem, Pennsylvania

Dale Newbury National Institute of Standards and Technology, Gaithersburg, Maryland

Jean-Paul Revel California Institute of Technology, Pasadena, California

Conly Rieder Wadsworth Center, Albany, New York

Phillip Russell Appalachian State University, Boone, North Carolina

John Silcox Cornell University, Ithaca, New York

Nestor Zaluzec Argonne National Laboratory, Argonne, Illinois

Editorial Board Representatives from Affiliated Societies

Ian Anderson NIST, Gaithersburg, Maryland (MAS)

Gema Gonzalez Venezuelan Institute for Scientific Investigation (Venezuela)

Michael Robertson Acadia University, Wolfville, Nova Scotia (Canada)

Brendan Griffin University of Western Australia (AMMS)

Guillermo Solorzano Pontificia Universidade Catolica, Rio de Janeiro (Brazil) Clive Walker Institute for Transuranium Elements, Karlsruhe (EMAS)

Miguel Yacaman Mexico Institute for Nuclear Research (Mexico)

Henrique Almeida Universidade do Porto (Portugal)

Founding Editor

Jean-Paul Revel California Institute of Technology, Pasadena, California

Previous Editors-in-Chief

Dale Johnson University of South Florida, Tampa, Florida Charles Lyman Lehigh University, Bethlehem, Pennsylvania

This journal is part of the **Cambridge Journals Online** service. Access to online tables of contents and article abstracts is available to all researchers at no cost. Access to full-text articles online is provided to those with online subscription. Online subscriptions must be activated. Once your subscription is activated, free access to past, present, and forthcoming articles is available at:

Microscopy and Microanalysis website: journals.cambridge.org/MAM.

Instructions for authors submitting manuscripts may be found at journals.cambridge.org/MAM. Select "Further Information" then select "Instructions for Contributors." An abbreviated version of these instructions will be published in the first issue (February) of each volume.

Microscopy and Microanalysis publishes original research papers dealing with a broad range of topics in microscopy and microanalysis. These include articles describing new techniques or instrumentation and their applications, as well as papers in which established methods of microscopy or microanalysis are applied to important problems in the fields of biology or materials science. Microscopy and microanalysis are defined here in a broad sense, and include all current and developing approaches to the imaging and analysis of microstructure. The criteria for acceptance of manuscripts are the originality and significance of the research, the quality of the microscopy or microanalysis involved, and the interest for our readership.

Four types of communications are published in the Journal. Regular Articles are of substantial length and describe the findings of an original research project that satisfies the aims and scope of the Journal, described above. Review Articles summarize the current status of an important area within the aims and scope of the Journal. Letters to the Editor usually contain comments on recent articles that have appeared in the Journal. Book Reviews are also published, but these are solicited only through the Book Review Editor.

Instructions for Contributors

Instructions for authors contributing manuscripts may be found at http://mc.manuscriptcentral.com/mam under "Resources: Instructions and Forms." Authors may also visit http://www.journals.cambridge.org/jid_MAM, select "Further Information," and then select "Instructions for Contributors." An abbreviated version of these instructions will be published in the first issue (February) of each volume.

Copyright Information

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the Microscopy Society of America; that the manuscript will not be published elsewhere in any language without the consent of the copyright holders; and that written permission of the copyright holder is obtained by the authors for material used from other copyrighted sources.

All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e.g., as offprints), as well as all translation rights. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher.

The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names lack protection by the relevant laws and regulation.

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Cambridge University Press, provided that the appropriate fee is paid directly to Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA (Tel: (508) 750-8400), stating the ISSN (1431-9276), the volume, and the first and last page numbers of each article copied. The copyright owner's consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

Disclaimer

The Microscopy Society of America, the other societies stated, and Cambridge University Press cannot be held responsible for errors or for any consequences arising from the use of the information contained in this journal. The appearance of scientific reports and/or workshops, or any other material in *Microscopy and Microanalysis* does not constitute an endorsement or approval by The Microscopy Society of America of the findings, data, conclusions, recommendations, procedures, results, or any other aspect of the content of such articles. The appearance of advertising in *Microscopy and Microanalysis* does not constitute an endorsement or approval by The Microscopy Society of America of the quality or value of the products advertised or any of

the claims, data, conclusions, recommendations, procedures, results, or any other information included in the advertisements.

While the advice and information in this journal is believed to be true and accurate at the date of its going to press, neither the authors, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made.

Subscription Information

Microscopy and Microanalysis is published bimonthly in February, April, June, August, October, and December by Cambridge University Press. Two supplements (Expo and Proceedings) are published in June and August.

Society Rates: Members of the Microscopy Society of America should contact the MSA Business Office for all subscription inquiries: Microscopy Society of America, Hachero Hill, Inc., 11260 Roger Bacon Drive, Suite 402, Reston, VA 20190, Tel.: (703) 964-1240, Ext. 14, E-mail: nicoleguy@mindspring.com, URL: www.msa.microscopy.org. Members of other affiliated societies should contact their respective society business offices for all subscription inquiries.

Subscription Rates: Institutions print and electronic: US \$920.00 in the USA, Canada, and Mexico; UK £555.00 + VAT elsewhere. Institutions online only: US \$760.00 in the USA, Canada, and Mexico; UK £460.00 + VAT elsewhere. Institutions print only: US \$830.00 in the USA, Canada, and Mexico; UK £500.00 + VAT elsewhere. Individuals print and online: US \$345.00 in the USA, Canada, and Mexico; UK £210.00 + VAT elsewhere. Prices include postage and insurance.

USA, Canada, and Mexico: Subscribers in the USA, Canada, and Mexico should send their orders, with payment in US dollars or the equivalent value in Canadian dollars, to: Cambridge University Press, Customer Services Department (Journals), 100 Brook Hill Drive, West Nyack, NY 10994-2133, USA. Tel: (845) 353-7500. Fax: (845) 353-4141. Orders may be phoned direct (toll free): (800) 872-7423. E-mail: journals_subscriptions@cup.org.

Outside North America: Subscribers elsewhere should send their orders, with payment in sterling, to: Customer Services Department (Journals), Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 8RU, UK. Tel: +44 (0)1223 326070. Fax: +44 (0)1223 325150. E-mail: journals@cambridge.org

Change of address: Allow six weeks for all changes to become effective. All communications should include both old and new addresses (with postal codes) and should be accompanied by a mailing label from a recent issue. Society members should contact their respective society business offices to inform them of address changes.

Microform editions are available from: University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106, USA.

Editorial Office

Robert L. Price, Editor in Chief, Department of Cell and Developmental Biology and Anatomy, School of Medicine, University of South Carolina, 6439 Garner's Ferry Road, Bldg. 1 B-60, Columbia, SC 29209, USA; Tel: (803) 733-3392; Fax: (803) 733-3212; E-mail: Bob.Price@uscmed.sc.edu.

Office of Publication

Cambridge University Press, 32 Avenue of the Americas, New York, NY 10013-2473, USA; Tel: (212) 337-5000; Fax: (212) 337-5959.

Advertising Sales & Production

M.J. Mrvica Associates, Inc., 2 West Taunton Avenue, Berlin, NJ 08009, USA; Tel: (856) 768-9360; Fax: (856) 753-0064.

© 2009 by Microscopy Society of America. Printed in the United States on acid-free paper. Periodicals postage paid at New York, NY, and additional mailing offices. Return postage guaranteed. Postmaster: Send address changes in the U.S.A. and Canada to *Microscopy and Microanalysis*, Subscription Department, Cambridge University Press, 100 Brook Hill Drive, West Nyack, NY 10994-2133.

Microscopy and Microanalysis

An International Journal for the Biological and Physical Sciences

Volume 15, Supplement 1 Richmond, Virginia, USA July 26-30, 2009

EXPO: MICROSCOPY AND MICROANALYSIS 2009

Calendar of Events	10
Richmond Convention Center Maps	11
Essential Meeting Information	
Business and Committee Meetings	13
Registration Fees	14
Shuttle Bus Schedule	14
Richmond Convention Center Information	15
Hotel Information M&M 2009 Social Events	15 16
MSA MegaBooth	18
Pre-Meeting Sunday Short Courses	20
Welcome from the Program Committee	22
Executive Program Committee	22
Program Committee Members	23
M&M 2009 Sponsors	24
In-Week Workshops and Special Events	24
In-Week Intensive Workshops	26 27
Special Events	
Local Host Committee Welcome	28
Welcome from the Society Presidents	30
Microscopy Society of America	32
Microbeam Analysis Society	40
International Metallographic Society	48
Week at a Glance	
Friday/Saturday/Sunday	55
Monday	56
Tuesday	58
Wednesday	60
Thursday	62
Symposia	
Advances in Instrumentation and Techniques Symposia	64
Biological Sciences Symposia	69 71
Physical Sciences Symposia Technologists' Forum Symposia	71
Late Breaking Posters	73
	10

Contents continued

Microscopy and Microanalysis website: journals.cambridge.org/MAM

Indexed in Chemical Abstracts, Current Contents, BIOSIS, and MEDLINE (PubMed)

Contents continued

Tutorials	
Biological Sciences Tutorials	75
Physical Sciences Tutorials	76
Joint Tutorials	77
Special Educational Events	78
Scientific Program	
Monday	79
Tuesday	87
Wednesday	104
Thursday	120
Author Index	129
Vendor Directory—Company Listing	141
Vendor Directory—Product and Services Listing	155
Exhibitor Directory and Exhibit Hall Floor Plan	166
Index to Advertisers	168