

The American Journal of **PATHOLOGY** Cellular and Molecular Biology of Disease

Editor-in-Chief

Michael P. Lisanti *Thomas Jefferson University*

Senior Associate Editor

Herbert B. Tanowitz *Albert Einstein College of Medicine*

Senior Assistant Editors

Philippe G. Frank *Thomas Jefferson University*

Federica Sotgia *Thomas Jefferson University*

Reviews Editors

Mikhail V. Blagosklonny *Ordway Research Institute*
Joseph R. Bertino *Cancer Institute of New Jersey*
Carlo M. Croce *The Ohio State University*
Ivan R. Nabi *University of British Columbia*
Richard G. Pestell *Thomas Jefferson University*
Stanley B. Prusiner *University of California, San Francisco*
Peter A. Ward *University of Michigan*

Associate Editors

Chris Albanese *Georgetown University Medical Center*
Vincent Castronovo *University of Liege*
Robert B. Clarke *University of Manchester*
Patricia A. D'Amore *Schepens Eye Research Institute*
Lora Hedrick Ellenson *Cornell University*
Michael R. Freeman *Children's Hospital/Harvard Medical School*
Martha B. Furie *Stony Brook University*
Philip Furmanski *Rutgers University*
Nisha Jain Garg *University of Texas Medical Branch*
Michael S. Goligorsky *New York Medical College*
Meera Hameed *Memorial Sloan-Kettering Cancer Center*
David M. Hockenbery *Fred Hutchinson Cancer Research Center*
Eric P. Hoffman *Children's National Medical Center*
Sergio A. Jimenez *Thomas Jefferson University*
Dontscho Kerjaschki *Medical University of Vienna*
Andrew A. Lackner *Tulane University*
William Lewis *Emory University*
Massimo Loda *Dana-Farber Cancer Institute*
James W. Mandell *University of Virginia*
Satdarshan (Paul) Singh Monga *University of Pittsburgh School of Medicine*
Asma Nusrat *Emory University*
Yasunori Okada *Keio University*
Charles A. Parkos *Emory University*
Andrew A. Quong *Thomas Jefferson University*
Kevin A. Roth *University of Alabama at Birmingham*
Hallgeir Rui *Thomas Jefferson University*
Philipp E. Scherer *University of Texas Southwestern Medical Center*
Jouni Uitto *Thomas Jefferson University*
Dani S. Zander *Penn State Milton S. Hershey Medical Center*

Managing Editor Audra E. Cox, PhD, ELS

Assistant Managing Editors Henry L. Carter, Jr.
Michael Dustin

Scientific Editor John W. Nelson, PhD

Editorial Assistants Emily J. Hamilton

The official journal of the American Society for Investigative Pathology seeks to publish high-quality, original papers on the cellular and molecular biology of disease. The editors accept manuscripts that advance basic and translational knowledge of the pathogenesis, classification, diagnosis, and mechanisms of disease, without preference for a specific analytic method. High priority is given to studies on human disease and relevant experimental models using cellular, molecular, animal, biological, chemical, and immunological approaches in conjunction with morphology.

<http://ajp.amjpathol.org>

Editorial Board

Sarki A. Abdulkadir	Ralf Gold	Juan P. Palazzo
Malcolm Alison	Jeffrey A. Golden	William C. Parks
Charles E. Alpers	Leonard G. Gomella	Tristram Parslow
Sebastiano Andò	Steven Gornias	Mercio A. PereiraPerrin
David W. Andrews	Avrum I. Gotlieb	George Perry
Peter Arvan	Gerald B. Grunwald	Sem H. Phan
Raffaele Baffa	Mary J.C. Hendrix	Marco Prisco
Renato L. Baserga	Setsuo Hirohashi	Michael B. Prystowsky
Kenneth E. Bernstein	Jeffrey C. Horowitz	Saul Puzsikin
Generoso Bevilacqua	Anton J. Horrovoets	Janardan K. Reddy
Gloria Bonucci	Anthony Howell	David L. Rimm
Jeff Boyd	Nicholas H. Hunt	Natalia A. Riobo
Arnold R. Brody	Lorraine Iacovitti	Enrique J. Rodriguez-Boulan
Jonathan R. Brody	Renato V. Iozzo	Charles L. Rosen
Daniel C. Bullard	Elaine S. Jaffe	Abdolmohamad Rostami
Bruno Calabretta	Jean-François Jasmin	Emanuel Rubin
Franco Capozza	Hanjoung Jo	David B. Sacks
Steven L. Carroll	Raghu Kalluri	Jeffrey E. Saffitz
Mathew C. Casimiro	Yashpal S. Kanwar	David S. Salomon
Wing (John) Chan	Sanjay Katiyar	Sam Santoro
George J. Christ	Levon M. Khachigian	Eveline E. Schneeberger
Erika Cione	Celina G. Kleer	John T. Seykora
Michael B. Cohen	Erik S. Knudsen	Darryl Shibata
William B. Coleman	Karen E. Knudsen	Gene P. Siegal
Paolo M. Comoglio	Edward Koo	Keith R. Solomon
Mark T. Curtis	Rakesh K. Kumar	David C. Spray
Robert D'Amato	Hans Lassmann	Patricia S. Steeg
Mark Damico	Andrea C. LeBlanc	William G. Stetler-Stevenson
Abhijit Dasgupta	Shengwen Li	David S. Strayer
Francesco Del Galdo	Jun Liu	Gary E. Striker
Dolores Di Vizio	Ricardo V. Lloyd	Peter Tipping
Dennis W. Dickson	Nicholas W. Lukacs	Jerrod R. Turner
Salvatore DiMauro	Fabiana Simão Machado	Mark L. Tykocinski
Jocelyn Dupuis	James L. Madara	Matt van de Rijn
Robert V.B. Emmons	Yves L. Marcel	Chenguang Wang
Jeffery A. Engelman	Ubaldo Martinez-Outschoorn	Lawrence M. Weiss
David M. Engman	Peter A. McCue	Louis M. Weiss
Ozlem Er	Jay M. McDonald	Alan Wells
Stephen M. Factor	Steven B. McMahon	Anthony Whetton
Nelson Fausto	Isabelle Mercier	Elizabeth M. Whitley
Thomas J. Flotte	Carlo Minetti	Monte S. Willis
Agnes Fogo	Kohel Miyazono	Agnieszka K. Witkiewicz
Michael L. Freeman	Thomas J. Montine	Isaac P. Witz
Matthew P. Frosch	Carlos S. Moreno	T.C. Wu
Giulio Gabbiani	George F. Murphy	Tesshi Yamada
Kevin L. Gardner	Ruth J. Muschel	Xiao-Ming Yin
Elisabetta Gazzero	Marja Nevalainen	David Zagzag
Godfrey S. Getz	Brian J. Nickoloff	Federico Zara
Andrew Gewirtz	Shuji Ogino	



Published by
The American Society for
Investigative Pathology

EXECUTIVE OFFICER: Mark E. Sobel

PRESIDENT: Martha Furie; **Past President:** Charles A. Parkos; **President-Elect:** Elizabeth R. Unger; **Vice President:** James M. Musser; **Secretary-Treasurer:** William B. Coleman; **Program Chair:** Asma Nusrat; **Education Committee Chair:** Richard N. Mitchell; **Committee for Career Development, Women and Minorities Chair:** Tara Sander; **Councilors:** David N. Louis, Daniel Remick, Kevin A. Roth; **ISBER Division Representative:** Scott Jewell; **PUBLICATIONS COMMITTEE:** William G. Stetler-Stevenson (Chair), Abul K. Abbas, Robert Bowser, William B. Coleman, Kevin Gardner, Martha Furie, Mark E. Sobel, Cecelia C. Yates, Dani S. Zander

Journal Information

The American Journal of Pathology is published monthly in print (ISSN 0002-9440) and online (ISSN 1525-2191) for the American Society for Investigative Pathology, Inc. by Elsevier Inc, 360 Park Ave S, New York, NY 10010-1710. Periodicals postage paid at New York, NY and additional mailing offices.

Business Office: 1600 John F. Kennedy Boulevard, Suite 1800, Philadelphia, PA 19103-2899. Accounting and Circulation Offices: 3251 Riverport Lane, Maryland Heights, MO 63043. Periodicals postage paid at New York, NY and additional mailing offices.

POSTMASTER: Send address changes to The American Journal of Pathology, Elsevier Periodicals Department, 3251 Riverport Lane, Maryland Heights, MO 63043.

CUSTOMER SERVICE (orders, claims, online, change of address):

Elsevier Periodicals Customer Service, 3251 Riverport Lane, Maryland Heights, MO 63043. Tel: (800) 654-2452 (U.S. and Canada); (314) 447-8871 (outside U.S. and Canada). Fax: (314) 447-8029. E-mail: JournalsCustomerService-usa@elsevier.com (for print support); journalsupport-usa@elsevier.com (for online support).

Address changes must be submitted four weeks in advance.

YEARLY SUBSCRIPTION RATES: United States and possessions: Individual \$352; Institution \$753. All other countries (prices include airspeed delivery): Individual \$467; Institution \$880. Single Issues \$74. To receive student/resident rate, orders must be accompanied by name of affiliated institution, date of term and the signature of program/residency coordinator on institution letterhead. Orders will be billed at the individual rate until proof of status is received. Current prices are in effect for back volumes and back issues.

Further information on this journal is available from the Publisher or from this journal's website (<http://ajp.amjpathol.org>). Information on other Elsevier products is available through Elsevier's website (<http://www.elsevier.com>).

Advertising information. Advertising and classified advertising orders and inquiries can be sent to: USA, Canada, and South America, Aileen Rivera, Integrated Sales Rep, Elsevier Inc., 360 Park Avenue South, New York, NY 10010; Phone: 212-633-3721; Fax: 212-633-3820; E-mail: a.rivera@elsevier.com. Europe and the rest of the world, Julie Toop; phone +44 (0) 1865 843016; fax +44 (0) 1865 843976; e-mail: media@elsevier.com.

Author inquiries

For inquiries relating to the submission of articles, contact the Editorial Office at 301-634-7959. For questions related to articles in press, visit <http://www.elsevier.com/authors>. The site also provides the facility to track accepted articles and set up e-mail alerts to inform you of when an article's status has changed, as well as detailed artwork guidelines, copyright information, frequently asked questions, and more. Please see Information for Authors for individual journal. Contact details for questions arising after acceptance of an article, especially those relating to proofs, are provided after registration of an article for publication.

Instructions for Authors can be found online at: <http://ajp.amjpathol.org>

Journal Scientific Integrity Policy can be found online at: <http://ajp.amjpathol.org>

The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

English language help service: Upon request, Elsevier will direct authors to an agent who can check and improve the English of their paper (before submission). Please contact authorsupport@elsevier.com for further information.

Reprints. For queries about author reprints, please contact Tracy Harding at 866-487-5625, 410-943-3085, 877-705-1373 (fax), or email at tracy.harding@cenveo.com.

© 2011 American Society for Investigative Pathology. All rights reserved.

This journal and the individual contributions contained in it are protected under copyright by the American Society for Investigative Pathology, and the following terms and conditions apply to their use:

Photocopying

Single photocopies of single articles may be made for personal use as allowed by national copyright laws. Permission of the Publisher and payment of a fee is required for all other photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and all forms of document delivery. Special rates are available for educational institutions that wish to make photocopies for non-profit educational classroom use.

Permissions may be sought directly from Elsevier's Rights Department in Oxford, UK: phone (215) 238-7869 or +44 (0) 1865 843830, fax +44 (0) 1865 853333, e-mail healthpermissions@elsevier.com. Requests may also be completed online via the Elsevier homepage (<http://www.elsevier.com/locate/permissions>).

In the USA, users may clear permissions and make payments through the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA; phone: (978) 750-8400, fax: (978) 750-4744, and in the UK through the Copyright Licensing Agency Rapid Clearance Service (CLARCS), 90 Tottenham Court Road, London W1P 0LP, UK; phone: (+44) 20 7631 5555; fax: (+44) 20 7631 5500. Other countries may have a local reprographic rights agency for payments.

Derivative Works

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution.

Permission of the Publisher is required for all other derivative works, including compilations and translations.

Electronic Storage or Usage

Permission of the Publisher is required to store or use electronically any material contained in this journal, including any article or part of an article.

Except as outlined above, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the Publisher.

Address permissions requests to: Elsevier Rights Department, at the fax and e-mail addresses noted above.

Notice

No responsibility is assumed by the Publisher or the American Society for Investigative Pathology for any injury and/or damage to persons or property as a result of any actual or alleged libelous statements, infringement of intellectual property or privacy rights, products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made.

Although all advertising material is expected to conform to ethical (medical) standards, inclusion in this publication does not constitute a guarantee or endorsement of the quality or value of such product or of the claims made of it by its manufacturer.