Copyright© 2008 by the American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814-3991. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage and retrieval system, except as may be expressly permitted by the 1976 Copyright Act or in writing from the publisher. Authorization to photocopy items for internal or personal use is granted by the publisher for libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of $8.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. 0363-6119/2008 $8.00.

Change of Address: The Journal must be advised of a change of address at least 6 weeks prior to date of issue, with both the subscriber’s old and new address given. Undelivered copies resulting from address change will not be replaced.

Change to the American Journal of Physiology—Regulatory, Integrative and Comparative Physiology. When available, $35.00 subscriber and $70.00 nonsubscriber each postpaid. Periodicals postage paid at Bethesda, MD and at additional mailing offices. POSTMASTER: Send address changes to the American Journal of Physiology, 9650 Rockville Pike, Bethesda, MD 20814-3991.

The American Journal of Physiology—Regulatory, Integrative and Comparative Physiology (ISSN-0363-6119) is published monthly (two volumes a year) by the American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814-3991 and online at www.ajpregu.org (ISSN 1522-1490). Subscription Prices (post-paid): Institutions (print and online): $720.00, US; $790.00, Canada and Mexico; $815.00, elsewhere. Institutions (print only): $700.00, US; $770.00, Canada and Mexico; $795.00, elsewhere. Institutions (online only): $595.00. Nonmember individual (print and online): $480.00, US; $550.00, Canada and Mexico; $575.00, elsewhere. Nonmember individual (print only): $465.00, US; $535.00, Canada and Mexico; $560.00, elsewhere. Nonmember individual (online only): $400.00. APS member (print only and online is free): $180.00, US; $250.00, Canada and Mexico; $275.00, elsewhere. Subscriptions from outside the United States are payable in US currency or full equivalent. Subscriptions are accepted on a calendar-year basis only. Single Copies and Back Issues: When available, $35.00 subscriber and $70.00 nonsubscriber each postpaid. Periodicals postage paid at Bethesda, MD and at additional mailing offices. POSTMASTER: Send address changes to the American Journal of Physiology—Regulatory, Integrative and Comparative Physiology, 9650 Rockville Pike, Bethesda, MD 20814-3991. Copyright © 2008 by the American Physiological Society. Printed in the United States of America by Cadmus Communications—Lancaster Division, Lancaster, PA 17601. The code at the bottom of the first page of an article indicates the copyright owner’s consent that copies of that article may be made beyond that permitted by sections 107 and 108 of the US Copyright Law—unless the copies are for general distribution, for advertising, for creating new works, or for resale—provided the per-copy fee is paid through the Copyright Clearance Center, Inc., 222 Rosewood Dr., Danvers, MA 01923. 0363-6119/2008 $8.00.

The American Journal of Physiology-Regulatory, Integrative and Comparative Physiology

Editor: C. D. SIGMUND

Associate Editors:
W. K. SAMSON (Deputy)
A. P. J. JOHNSON
U. C. KOPP

P. B. PERSSON
W. M. BRANDS
E. J. BRAUN
V. L. BROOKS
J. G. CANNON
K. CARN
L. A. CASSIS
M. W. CHAPLEAU
S. CHEMTORT
D. CLEG
M. A. COWLEY
J. T. CUNNINGHAM
W. A. CUPPLES
R. K. DAMPNEY
R. L. DAVISSON
G. E. DE SOUZA
M. D. DILENZO
J. R. DEITZ
P. D’ORLEANS-JUSTE
A. J. DOUGLAS
H. EHMKE
D. H. EVANS
J. FANDREY
A. V. FERGUSON
P. W. FYNN

J. C. FRISBIE
J. L. GARVIN
N. GASSMANN
R. GERSTERBERGER
A. Y. GRACEY
J. P. GRANGER
G. H. GREENE
O. GRISK
R. W. GROSS
K. L. GROVE
P. G. GUYENET
R. B. S. HARRIS
P. J. HAVEL
C. HINOJOYA-LARBORDE
Y. HIROOKA
N. H. HOLSLEIN-RATHLOU
J. D. IMIG
B. IVERSEN
D. C. JACKSON
S. E. JACOBS-KAUFMAN
B. J. A. JANSEN
B. L. JENSEN
E. J. JOHNS
J. JORDAN
P. JOSÉ
C. JULIEN
A. JUST
H. KEEN
R. A. KHALIL
H. KIRCHHEIM
C. M. KOTZ
A. KURTZ
F. C. LANG
A. LAWRENCE
T. E. LOHMEIER
C. LORETTZ
G. N. LUHESHI
S. MARTIN
D. L. MATTSON
R. MCALEN
M. J. MCKINLEY
D. MILLER
J.-P. MONTANI
T. H. MORAN
S. F. MORRISON
M. NIKNIMA
B. OLDFIELD
K. OLSON
Y. OMORI
S. E. OZANNE
G. PARATI
A. PATZAK
P. M. PIŁOWSKY
J. S. POLLOCK
J. B. PRITCHARD
H. RAFF
K. RAHMOUNI
M. K. RAIZADA
D. C. RANDALL
J. F. RECKELHOFF
R. D. REIDELBERGER
J. L. RENFRO
R. RETTIG
L. M. RINAMAN
R. A. ROBERGS
A. E. ROBLIN
R. J. ROMAN
A. A. ROMANOVSKY
M. G. ROSS
J. ROTH
T. RUF
M. J. RYAN
F. J. SALAZAR
H. SAPRU
M. N. SAWKA
H. D. SCHULTZ
C. SCHNACKENBERG
J. SCHNIRRMANN
A. M. SCHREIHOFER
H. SCHOLZ
J. L. SEgar
O. SKJFTT
R. S. SPRAIGUE
H. STAUS
D. W. STEPP
E. M. STRICKER
A. F. SVE SCALE
D. B. THOMASON
G. M. TONEY
J. H. URBAN
A. J. M. VERBERNE
A. G. WATTS
S. W. WATTS
R. S. WEISSINGER
W. J. WELCH
L. L. WOODS
J. M. WYSS
Y. YOSHIDA
T. T. ZITTEL
I. H. ZUCKER

Ex officio
M. REICH
Director of Publications
H. CAREY, President
M. FRANK, Executive Director

M. L. GOODWIN
Editorial Manager
B. A. RUDE
Journal Supervisor
L. KANASKIE
Copy Editor