

# American Journal of Physiology- Renal Physiology

**Editor:** T. R. KLEYMAN

---

**Associate Editors:**

G. APODACA  
P. D. BELL

J. L. GARVIN  
L. M. SATLIN

K. SHARMA  
S. M. WALL

---

**Editorial Reviews Board:**

J. BONVENTRE, M. CAPLAN, D. ELLISON, M. A. KNEPPER, I. KURTZ, W. M. LEVI, J. M. SANDS, *United States*

R. J. BINDELS, F. LANG, S. NIELSEN, O. STAUB, F. VERREY, *Europe*

J. Y. LAPOINTE, *Canada*  
P. PORONNIK, *Australia*

M. IMAI, *Japan*  
G. GAMBA, *South America*

H. GARTY, *Israel*

---

**Editorial Board:**

A. AGARWAL  
B. ALEXANDER  
S. M. BAGNASCO  
D. BASILE  
M. BAUM  
W. H. BEIERWALTES  
M. BEVENSEE  
V. BHALLA  
D. BIEMESDERFER  
M. BLOUNT  
H. L. BROOKS  
F. BROSIUS  
L. BRUGGEMAN  
M. BUTTERWORTH  
H. CAI  
M. CARATTINO  
T. CHAI  
G. CHEN  
S. CHEN  
R. CUNARD  
W. A. CUPPLES  
Z. DONG  
H. DRUMMOND  
K. DUNN  
D. EATON  
C. ECELBARGER  
A. EDWARDS  
D. ELADARI  
R. FENTON  
J. FRØKLÆR

J. GILBERT  
M. GOLIGORSKY  
J. L. GOOCH  
V. HAASE  
K. R. HALLOWS  
K. HAMILTON  
L. HARRISON-BERNARD  
M. HERRERA  
W. HILL  
R. R. HIRSCHBERG  
J. D. IMIG  
R. S. HOOVER  
R. P. HUGHEY  
E. W. INSCHO  
E. K. JACKSON  
P. A. JOSE  
Y. KANWAR  
G. P. KAUSHAL  
B. K. KISHORE  
K. KITAMURA  
J. D. KLEIN  
D. E. KOHAN  
T. LE  
S. LINAS  
J. H. LIPSCHUTZ  
Y. LIU  
J. LORENZ  
H. MAKINO  
C. MARIC  
J. MARRS

D. L. MATTSON  
F. MCDONALD  
A. A. MCDONOUGH  
M. MENDEZ  
O. W. MOE  
J. MORRISSEY  
M. NANGAKU  
R. NATARAJAN  
T. OBARA  
P. O'CONNOR  
M. OKUSA  
P. A. ORTIZ  
B. PADANILAM  
T. L. PALLONE  
L. G. PALMER  
A. PAO  
N. PASTOR-SOLER  
D. PEARCE  
V. PECH  
J.-B. PENG  
J. PETI-PETERDI  
G. PETKOV  
O. POCHYNYUK  
D. M. POLLOCK  
J. POLLOCK  
S. R. PRICE  
H. RABB  
P. RATZ  
J. F. RECKELHOFF  
N. E. RHALEB

T. RIEG  
M. F. ROMERO  
M. ROSS  
R. SABAN  
P. W. SANDERS  
S. SANSOM  
R. G. SCHNELLMANN  
D. SHEIKH-HAMAD  
S. SHENG  
R. SPURNEY  
A. STARUSCHENKO  
A. SUBRAMANYA  
J. SULLIVAN  
A. SWIATECKA-URBAN  
H. TRACHTMAN  
V. VALLON  
M. VIZZARD  
J. B. WADE  
C. WAGNER  
W. WANG  
A. WEINSTEIN  
W. J. WELCH  
P. A. WELLING  
S. H. WRIGHT  
T. YANG  
A. S. L. YU  
R. ZAGER  
R. ZATZ

---

**Publications Committee**

H. RAFF, *Chair*  
W. CHILIAN  
S. J. GUNST  
A. MALIK  
J. M. METZGER  
D. POLLOCK  
L. C. SAMUELSON

*Ex officio*

R. SCHEMAN  
*Director of Publications  
and Executive Editor*  
S. BARMAN, *President*  
M. FRANK, *Executive Director*

M. L. GOODWIN

*Editorial Manager*  
S. DEMMA  
*Journal Supervisor*  
J. MARQUEZ  
*Copy Editor*

G. EBNER

*Peer Review Manager*  
E. PESANELLI  
*Editorial Art Manager*  
A. McEVER  
*Editor's Assistant*

---

The *American Journal of Physiology-Renal Physiology* (ISSN-1931-857X) is published twice monthly online at [ajprenal.org](http://ajprenal.org) (ESSN-1522-1466). (two volumes a year) by the American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814-3991. *Subscription Prices (postpaid):* For institutional print and online pricing, please see <http://www.the-aps.org/publications/subs/>. Non-member individuals (online only): \$370.00. APS members: online is free. Print back issues when available, through December 2011: subscriber, \$40 each; nonsubscriber, \$75 each. Subscriptions from outside the United States are payable in US currency or full equivalent. Subscriptions are accepted on a calendar-year basis only. Periodicals

postage paid at Bethesda, MD and at additional mailing offices.

Copyright © 2013 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.

*Editorial and Business Correspondence:* AJP-Renal Physiology, 9650 Rockville Pike, Bethesda, MD 20814-3991.

**Disclaimer:** The statements and opinions contained in the articles of the *American Journal of Physiology-Renal Physiology* are solely those of the individual authors and contributors and not of the American Physiological Society. The appearance of advertisements in the journal is not a warranty, endorsement, or approval of the products or their safety. The American Physiological Society disclaims responsibility for any injury to persons or property resulting from any ideas or products referred to in any article or advertisement.