

American Journal of Physiology- Gastrointestinal and Liver Physiology®

Editor: Nigel W. Bunnett

Deputy Editor:
Denise M. Ney

Associate Editors:

Michael Camilleri
Andrew S. Giraud
Stephen J. Pandolf

Charalabos Pothoulakis
Detlef Schuppan

Natalie J. Torok
Nathalie Vergnolle

Editorial Board:

David Adams
Hamid Akbarali
David Alpers
Gianfranco Alpini
Waddah A. Alrefai
Christophe Altier
Nadia A. Ameen
Sarah Andres
Gregory Aponte
Minoti Apte
Samuel Asfaha
Giovanni Barbara
Donatella Barisani
Kim Barrett
Christoph Becker
Premysl Berck
Charles L. Bevins
Michael J. Beyak
Adil Bharucha
L. Ashley Blackshaw
Diego Bohorquez
Suart Brierley
Kirsteen Browning
Douglas Burrin
Patrice D. Cani
Simona E. Carbone
Nicholas Clemmons
Sean Colgan
James F. Collins
Helen Cox
Christopher M. Dekaney
Inge Depoortere
Céline Deraison
Shengli Ding
Steven Dooley
Jonathan A. Dranoff
Pradeep K. Dudeja
Lars Eckmann

Laura Edgington-Mitchell
Luca Fabris
Giamila Fantuzzi
Gianrico Farrugia
Audrey Ferrand
Tobias L. Freitag
Mark R. Frey
Teresa Frisan
James Galligan
Bin Gao
Lara R. Gawenis
Sudip K. Ghosh
D. Neil Granger
John R. Grider
Guy Groblewski
Ajay S. Gulati
Aida Habtezion
Kathryn E. Hamilton
Karen M. Harnett
Michael Helmuth
Simon A. Hirota
Simon P. Hogan
Dimitrios Iliopoulos
Louise Judd
Peter J. Kahrlas
Iordanis Karagiannidis
Jonathan D. Kaunitz
Stephen Keely
Kimberly Kirkwood
Jan-Michael A. Klapproth
Claude Knauf
Efi Kokkotou
John F. Kuenmerle
Subhash Kulkarni
Philippe Langella
Craig Logsdon
Sophie Lotersztajn
Veronika Lukacs-Kornek

Wallace MacNaughton
Scott Magness
Jelena Mann
Kara Gross Margolis
John M. Mariadason
Martín G. Martín
Emmanuel Mas
Julia Mayerle
Declan F. McCole
Trevelyan R. Menheniott
Didier Merlin
Delphine Meynard
Jason C. Mills
Satdarshan (Paul) Singh Monga
Marshall Montrose
Karnam S. Murthy
Laura E. Nagy
Andrew S. Neish
Michel Neunlist
Natalia Nieto
Amanda J. Page
Joseph F. Pierre
Daniel Poole
Yury Popov
Elizabeth Powell
D. Mark Pritchard
Claire Raceaud-Sultan
Satish S. C. Rao
Satish Rattan
Florian Rieder
Malvyn Rolli-Derkinderen
Rachel Rigby
Krista Rombouts
Deborah C. Rubin
Hamid M. Said
Ashok K. Saluja
Linda C. Samuelson
Tor Savidge

Jörn M. Schattenberg
Bernad Schnabl
Terez Shea-Donohue
Le Shen
Vijay P. Singh
Nick Spencer
Shanthi Srinivasan
Lincon A. Stamp
William Stenson
Catia Sternini
V. Nathan Subramaniam
Philip Sutton
Yvette Taché
Frank Tacke
Andreas Teufel
Arianne L. Theiss
Andrea Todisco
R. Alberto Travaghi
Jonel Trebicka
Jerrold R. Turner
Laurianne Van Landeghem
Lukas Van Oudenhove
Pieter Vanden Bergh
Nicholas Veldhuis
Elena F. Verdu
G. Nicholas Verne
Maria Vicario
Cécile Vignal
John L. Wallace
Jian-Ying Wang
Sean M. Ward
John A. Williams
Dan Worthley
Vincent W. Yang
C.-L. Eric Yen
Heather M. Young
C. Chris Yun
Yana Zavros

Publications Committee

Curt D. Sigmund, *Chair*
Hershel Raff, *Vice Chair*
Catherine E. Carr
Andrew Greene
Paul A. Insel
Alicia A. McDonough
Susan M. Wall
Loren Wold

Ex officio

Rita Scheman
*Director of Publications
and Executive Editor*
Jane F. Reckelhoff, *President*
Dennis Brown, *President-Elect*
Patricia E. Molina, *Past President*
Martin Frank, *Executive
Director*

Audra E. Cox
Editorial Manager
Ellyn Kestnbaum
Journal Supervisor
Gilbert Ebner
Peer Review Manager
Jami Jones
Peer Review Coordinator

Eric Pesanelli
Editorial Art Manager
Josh Robbs
Editor's Assistant

The *American Journal of Physiology-Gastrointestinal and Liver Physiology* (ISSN-0193-1857) is published twice monthly online at www.ajpgi.org (two volumes a year) by the American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814-3991 (ISSN 1522-1547). *Subscription Prices (postpaid)*: For institutional print and online pricing, please see <http://www.the-aps.org/publications/subs>. Nonmember individuals (online only) \$440.00. APS members: online is free. Subscriptions from outside the United States are payable in US currency or full equivalent. Subscriptions are accepted on a calendar-year basis only. Print back issues, when available, through December 2011: Subscriber, \$45 each; Nonsubscriber, \$90. Periodicals postage paid at Bethesda, MD and at additional mailing offices.

The *American Journal of Physiology-Gastrointestinal and Liver Physiology*® is a registered trademark of the American Physiological Society.

Copyright © 2016 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-Gastrointestinal and Liver Physiology, 9650 Rockville Pike, Bethesda, MD 20814-3991.

Disclaimer: The statements and opinions contained in the articles of the *American Journal of Physiology-Gastrointestinal and Liver 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.