

Journal of Animal Science

Editor-in-Chief: Gregory S. Lewis

Animal Genetics:
Molecular Genetics
Quantitative Genetics

M. D. MacNeil (2014), Division Editor
D. Berry (2016), Associate Editor
M. Gonda (2015), Associate Editor
C. Li (2016), Associate Editor
D. Nonneman (2014), Associate Editor
L. Varona (2014), Associate Editor
B. Weaber (2014), Associate Editor

Animal Physiology:
Cell Biology
Growth and Developmental Biology

S. Johnson (2014), Division Editor
T. Brandebourg (2015), Associate Editor
K. Govoni (2016), Associate Editor
R. Rhoads (2014), Associate Editor
L. Spicer (2014), Associate Editor

Physiology, Endocrinology, and Reproduction

Animal Nutrition:
Nonruminant Nutrition
Ruminant Nutrition

S. W. Kim (2016), Division Editor
J. Caton (2016), Division Editor
S. Baidoo (2016), Associate Editor
T. Crenshaw (2015), Associate Editor
J. Patience (2016), Associate Editor
C. Reinhardt (2014), Associate Editor
B. Rude (2016), Associate Editor
C. Stahl (2016), Associate Editor
P. Thacker (2015), Associate Editor
E. Titgemeyer (2016), Associate Editor
Y. Wang (2016), Associate Editor

Animal Production:
Behavior
Environmental Impact
Feedstuff Evaluation
Health and Well-Being
Management
Pharmacology and Toxicology
Rangeland, Pasture, and Forage Utilization

J. Villalba (2016), Division Editor
R. Anderson (2014), Associate Editor
T. Devries (2014), Associate Editor
J. Klotz (2014), Associate Editor
A. Leytem (2014), Associate Editor
K. Soder (2016), Associate Editor
B. Taylor (2014), Associate Editor

Animal Products:
Meat Science and Muscle Biology
Pre- and Postharvest Product Safety

S. Lonergan (2016), Division Editor
R. Mancini (2014), Associate Editor
S. P. Suman (2016), Associate Editor
D. VanOverbeke (2016), Associate Editor

Special Topics:
Biographical/Historical Sketches
Contemporary Issues
Teaching

R. Dailey (2015), Division Editor

Symposia

M. Mirando (2015), Editor

ACSESS Editorial and Production Staff: Mark Mandelbaum Emily Mueller (emueller@sciencesocieties.org) Brett Holte Karen Brey

Editorial Board

Gbola Adesogan (2013)
Jason Ahola (2013)
Shawn Archibeque (2013)
Paul Beck (2014)
Giuseppe Bee (2016)
Werner Bergen (2016)
Donagh Berry (2014)
Mario Binelli (2016)
Dustin Boler (2016)
Barry Bradford (2013)
Christy Bratcher (2017)
Andre Brito (2013)
David Buchanan (2016)
Kristi Cammack (2015)
Kasey Carlin (2017)
Dale Coleman (2014)
Reinaldo Cooke (2014)
Robert Cushman (2016)
Jared Decker (2016)
Robert Delmore (2016)
Anna Dilger (2016)
Ryan Dilger (2016)
Roberto Distel (2016)
Jean-Yves Dourmad (2014)
Susan Duckett (2014)
Min Du (2013)
Ted Elsasser (2014)
Shelby Filley (2014)
Mark Froetschel (2013)
Rick Funston (2016)
John B. Gaughan (2016)
Elizabeth Gilbert (2014)
Cecile Ginane (2016)

Robert Goodband (2014)
John Gonzalez (2014)
Pablo Gregorini (2016)
Tanya Gressley (2014)
Jesse Grimes (2016)
Kevin Harvatine (2013)
Ben Hayes (2015)
Shanna Ivey (2016)
Tim Keady (2013)
Beob Gyun Kim (2016)
Jan Kotwica (2016)
Scott Kronberg (2016)
Ilias Kyriazakis (2014)
G. Cliff Lamb (2016)
James Lauderdale (2013)
Laurie Lawrence (2014)
Jerrad Legako (2018)
Clay Lents (2016)
Gustavo J. M. M. Lima (2016)
Julie Long (2014)
Peadar Lowlor (2016)
Elizabeth Maga (2014)
Raluca Mateescu (2016)
José F. M. Menten (2016)
Phil Miller (2016)
Frank Monahan (2017)
Christopher Mortensen (2016)
Rainer Mosenthin (2016)
Raphael Mrode (2014)
Gordon Murdoch (2013)
Kiyoshi Okuda (2016)
Robert Payne (2014)
James Pfister (2016)

Xiangshu Piao (2016)
A. Radunz (2013)
Ravi Ravindran (2014)
Sarah Reed (2014)
Charlotte Rehfeldt (2016)
Leah Rempel (2016)
Peter Ryan (2013)
Guillermo Scaglia (2016)
Chris Schauer (2014)
Jason Scheffle (2016)
Gerald Shurson (2016)
Jeff Sindelar (2016)
Burt Staniar (2014)
Juan Steibel (2014)
Alex Steizleni (2015)
Gary Sullivan (2018)
Robert Tempelman (2014)
David Townson (2013)
Jesse Trushenski (2016)
Keith Underwood (2013)
Kristine Urschel (2016)
Eugene Ungar (2016)
Alison Van Eenennaam (2015)
Judson Vasconcelos (2014)
Kimberly Vonnahme (2016)
Terry Ward (2014)
Amanda Weaver (2017)
Robert Wettemann (2016)
Matt Wilson (2014)
Paul Wistuba (2014)
Aimee Wurtz (2014)
Janeal Yancey (2016)

Terms expire on July 15 of the year indicated

Officers and Directors of the American Society of Animal Science

G. P. Lardy, *President*
D. K. Aaron, *President-Elect*
J. L. Sartin, *Past President*
M. Wulster-Radcliffe, *Chief Executive Officer*
D. E. Hawkins, *Program Chair and Director-at-Large*
D. P. Casper, *Foundation Trustee Chair*
J. C. Weigel, *ASAS Representative to FASS*

E. B. Kegley, *Recording Secretary and Director-at-Large*
G. S. Lewis, *Editor-in-Chief*
N. R. Merchen, *Midwestern Director*
T. A. Hoagland, *Northeastern Director*
R. B. Muntfering, *Southern Director*
J. C. Whittier, *Western Director*
J. Hemmelgarn, *Chief Operations Officer*

S. L. Archibeque *Director-at-Large*
T. A. Armstrong, *Director-at-Large*
W. L. Flowers, *Director-at-Large*
H. C. Freetly, *Director-at-Large*
C. K. Larson, *Director-at-Large*
E. Lonergan, *Director-at-Large*
L. C. Martin, *Director-at-Large*
C. L. Maxwell, *Graduate Director*
W. B. Smith, *Graduate Director*

Application for membership in the American Society of Animal Science (ASAS) is invited from persons with interest in animal science and livestock production. In 2014, annual dues including access to the electronic version of the *Journal of Animal Science* are \$135 in the United States, Canada, and Mexico and in other countries. For those in the United States, Canada, or Mexico who wish to receive a paper copy of the journal, the additional fee is \$200; for those in other countries, the additional fee is \$300. Student affiliate membership is granted to those who are certified by a professional member as a regularly enrolled college student who does not hold a full-time position at the time of application for, or annual renewal of, membership. Graduate student memberships (\$20 annually) and undergraduate student memberships (free) include access to the electronic version of the *Journal of Animal Science*. Postdoctoral fellows' membership dues are \$65. An institutional subscription (\$599 annually) entitles an institution Internet access to e-JAS within appropriate IP addresses. For an additional \$125 fee, institutions within the United States, Canada, and Mexico will receive a paper copy of the journal (an additional \$150 fee for all other countries). For corporate subscriptions, please contact the ASAS office for pricing. Individual sustaining membership, \$375 per year. Applications for membership with remittance should be mailed to the ASAS Business Office.

ASAS Business Office, PO Box 7410, Champaign, IL 61826
Telephone: 217-356-9050; Fax: 217-689-2436; E-mail: asas@asas.org Office hours: 8:00 a.m.–5:00 p.m.

American Society of Animal Science World Wide Web address: <http://www.asas.org>

Calendar of American Society of Animal Science Upcoming Meetings

Midwestern Section (with ADSA)	March 16–18, 2014	Des Moines, IA
Western Section	June 24–26, 2014	San Angelo, TX
Northeast Section	July 20–24, 2014	Kansas City, MO
National Annual Meeting (with ADSA)	July 20–24, 2014	Kansas City, MO

Manuscript Submission. Information about manuscript submission is given in *Style and Form* published on the journal website (<http://jas.fass.org>). All manuscripts submitted to the *Journal of Animal Science* must be accompanied by the JAS manuscript submission form certifying that any research that involves animals has followed established standards for the humane care and use of animals. Manuscripts should be submitted online via <http://mc.manuscriptcentral.com/jas>.

Address Change and Missing Copies. Notice of change in address should be received by the ASAS Business Office 60 days in advance of change. A claim for a missing copy of the *Journal of Animal Science* should be received within 30 days (90 days foreign) after publication date to ensure replacement at no additional charge. The current policy is one replacement per monthly issue of the *Journal of Animal Science*. If additional replacements are requested beyond that, a single-issue price of \$60 per issue domestic and \$65 per issue foreign shall be charged. These prices reflect the current single issue pricing structure.

Journal of Animal Science (ISSN 0021-8812) is published 12 times per year (monthly) by the American Society of Animal Science. Periodicals postage paid at 201 W. Springfield, Ste 1202, Champaign, IL 61820 and at additional mailing offices. Form 3579 to be returned to the ASAS Business Office. Postmaster: Send change of address to American Society of Animal Science, PO Box 7410, Champaign, IL 61826.

Copyright 2014 by the American Society of Animal Science. Printed in USA. All rights reserved. Reproduction in part or whole is prohibited.