INSTRUCTIONS FOR AUTHORS (REVISED 2015)
Journal of Animal Science

The Instructions for Authors, Journal of Animal Science (JAS) is divided into 2 sections:

I. Manuscript Preparation, which describes the Style and Form that authors must follow in the preparation of manuscripts; and

II. Policies and Procedures of JAS, which describes the mission of JAS, contact information, care and use of animals, protection of human subjects, conflict of interest, types of articles published in JAS, manuscript submission, copyright policies, review procedures and policies, papers in press, author proofs, and publication charges.

I. MANUSCRIPT PREPARATION
(STYLE AND FORM)

The most important thing authors can do as they prepare their manuscripts is to consult a recent issue of JAS to see the acceptable format for headings, title page, ABSTRACT, Key words, INTRODUCTION, MATERIALS AND METHODS, RESULTS, DISCUSSION (or combined RESULTS AND DISCUSSION), LITERATURE CITED, and tables and figures (including figure captions). Each of these topics is described in this document. The headings are shown in uppercase letters to illustrate how they should appear in manuscripts. A basic manuscript template in Microsoft Word is available at http://www.animalsciencepublications.org/publications/jas/infora. Manuscripts that are not consistent with the Instructions for Authors will be immediately rejected.

General. Manuscripts must be written in English and must use American spelling and usage, as well as standard scientific usage. The following online resources provide detailed information.

- For general style and form, authors should follow that recommended in Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers. 7th ed. Council of Science Editors, Reston, VA.
- For American English spelling and usage, consult Merriam-Webster Online. http://www.m-w.com/
- For how to use numbers, refer to Policies Regarding Number Usage later in this document.
- For SI units, the National Institute of Standards and Technology provides a comprehensive guide. http://physics.nist.gov/cuu/Units/index.html
- For capitalization and spelling of plants, consult the USDA Plants website. http://plants.usda.gov
- For bacterial nomenclature, consult Approved Lists of Bacterial Names. http://www.bacterio.net/alintro.html

Manuscripts should be prepared double-spaced in Microsoft Word, with lines and pages numbered consecutively, using Times New Roman font at 12 points and no less than 2.54-cm (1 inch) margins all around. Special characters (e.g., Greek and symbols) should be inserted using the symbols palette available in this font. Complex equations should be entered using MathType (http://www.dessci.com/en/products/mathtype/). Tables and figures should be placed in separate sections at the end of the manuscript, and not placed in the text. Manuscripts should be uploaded to Thomson Reuters Scholar-One Manuscripts (formerly called Manuscript Central) using the fewest files possible to facilitate the review and editing processes.

Manuscripts should contain the following sections in this order.

Title Page. The title page includes a running head (the first word only and any proper nouns capitalized and no more than 45 keystrokes [i.e., characters and spaces; a space is counted as a keystroke]); the title (only the first word and any proper nouns capitalized, as brief as possible, and including the species involved); names of authors (e.g., T. E. Smith; no title, positions, or degrees) and institutions, including the department, city, state or country (all with first letters capitalized), and ZIP or postal code. Author affiliations are footnoted using the symbols *, †, ‡, §, #, ║, and ¶ and are placed below the author names. If a consortium is listed in the byline, a footnoted reference to a website showing the names and affiliations of each member of the consortium should be included in acknowledgements; names and affiliations of each member of the consortium will not be listed on the title page. Superscript numbers are used to reference footnotes on the first page. Acknowledgments, including acknowledgements of consortia, grants, experiment station, or journal series number, are given as a footnote to the title. Authors disclosing potential or actual conflicts of interest related to the research presented in the manuscript should describe this in a footnote with other acknowledgements (for details, see Conflict of Interest).

Abstract. ABSTRACT consists of no more than 2,500 keystrokes (characters and spaces) in one paragraph and contains a summary of the pertinent results, with statistical evidence (i.e., P-values), in a brief but understandable form, beginning with a clear statement of the objective and ending with the conclusions, with no references cited. Abbreviations in the abstract that are not in Standard JAS Abbreviations must be defined at first use.

Key words. List up to 6 key words or phrases including the species, variables tested, and major response criteria. The first letter of each key word is lowercase,
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unless it is a proper noun; key words are separated by commas and presented in alphabetical order; and no abbreviations should be used. Because major words in the title are not used for the subject index, which is published in the last issue of each volume of *JAS*, appropriate words from the title should be listed as key words.

**Introduction.** INTRODUCTION must not exceed 2,000 keystrokes (characters and spaces) and must contain a brief justification for conducting the research, the hypotheses to be tested, and the objective(s). Extensive discussion of relevant literature should be included in DISCUSSION, not in INTRODUCTION.

**Materials and Methods.** MATERIALS AND METHODS is a required section and must contain a clear description or specific original reference for all biological, analytical, and statistical procedures. All modifications of procedures must be explained. Diets, dates of experimental activities if appropriate, animals (breed, sex, age, body weight, and weighing conditions [i.e., with or without restriction of feed and water]), surgical techniques, measurements, and statistical models should be described clearly and fully. Manu-

**Commercial Products.** Appropriate statistical methods should be used, although the biology should be emphasized. Statistical methods commonly used in the animal sciences need not be described in detail, but adequate references should be provided. The statistical model, classes, blocks, and experimental unit must be designated. Any restrictions used in estimating parameters should be defined. Reference to a statistical package without reporting the sources of variation (classes) and other salient features of the analysis, such as covariance or orthogonal contrasts, is not sufficient. Always reference SAS with the manufacturer information (SAS Inst. Inc., Cary, NC); do not call out as a reference in LITERATURE CITED. The threshold (e.g., $P < 0.05$) for significance should be stated. A statement of the results of the statistical analysis should justify the interpretations and conclusions. The experimental unit is the smallest unit to which an individual treatment is imposed. Measurements on the same experimental unit over time are not independent and should not be considered as independent experimental units. Provide a validation for assays (e.g., mean and CV for repeated analysis of a sample [both between and within-assay if available] and the sensitivity [minimum amount or concentration detectable]). Also, provide a publication reference for the methods used in kits. Centrifugal force should be provided in × g, not rpm, and duration and temperature of centrifugation must be included. Include volume of blood collected, container used, and amount of preservative or anticoagulant (e.g., 10 μL of heparin).

**Results.** RESULTS are presented in the form of tables or figures when feasible. The text should explain or elaborate on the tabular data, but numbers should not be repeated within the text. Sufficient data, all with some index of variation attached, including significance level (i.e., $P$-value), should be presented to allow readers to interpret the results of the experiment. Reporting the $P$-value is preferred to the use of the terms significant and highly significant, which are more editorial than quantitative descriptions. Thus, the $P$-value (e.g., $P = 0.042$ or $P < 0.05$) should be presented, thereby allowing readers to decide what to reject. Other probability (alpha) levels may be discussed if properly qualified so that the reader is not misled (e.g., trends in the data).

**Discussion.** DISCUSSION contains the author’s, or authors’, interpretations of the results of the study. The presentation should be clear and concise, address biological mechanisms and their significance, and integrate the research findings with the body of previously published literature to provide readers with a broad base on which to evaluate the author’s, or authors’, interpretations and assertions. Authors may speculate, but they should make it clear that their statements are speculative, rather than factual. A stand-alone DISCUSSION should not refer to any tables or figures, nor should it include $P$-values, unless citing a $P$-value from another work. The discussion must be consistent with the data from the research.

**Results and Discussion.** In *JAS*, authors have the option of combining the results and discussion into one section.

**Literature Cited.** To be listed in LITERATURE CITED, papers must be published or accepted for publication (“in press”). Personal communications and unpublished data must not be included in LITERATURE CITED. Guidelines and formats for references and citations are described in the Literature Cited Section of this document.

**Tables and Figures.** Tables and figures must be prepared so they meet the stand-alone criterion; that is, information in a table or figure can be understood without referring to information in the body of the manuscript. Tables and figures shall be placed at the end of the manuscript. Each table and each figure shall be placed on a separate page (separated with section breaks) and identified with table and figure numbers. Manufacturer-defined abbreviations must be defined (or redefined) in each table and figure. Manufacturer name and location must be provided for any proprietary product appearing in a table or figure.

Tables must be created using the table feature in MS Word (for instructions, see Guidelines for Creating Tables Using Microsoft Word [http://www.animalsciencepublications.org/files/publications/jas/word-tablesguidelines-jas.pdf]). Refer to a recent issue of *JAS* for examples of table construction. When possible, tables should be organized to fit across the page (i.e., portrait layout) without running broadside (i.e., landscape). Each column must have a heading (e.g., Item, Ingredi-

**Quality Guidelines for Journal of Animal Science (JAS) Figures** (http://www.animalsciencepublications.org/files/pub-
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Additional Usage Notes

**Numbers.** For details, see Policies Regarding Number Usage for *Journal of Animal Science* later in this document.

**Abbreviations.** Except to begin a sentence and when specifically contraindicated (e.g., units of time should only be abbreviated when used with a number), authors must use the abbreviations that are listed in this document under **STANDARD JAS ABBREVIATIONS**. Abbreviations in the text that are not listed in **STANDARD JAS ABBREVIATIONS** must be defined at first use, unless they are international abbreviations for elements, units of measure, amino acids, and chemicals, as examples. Abbreviations listed in **STANDARD JAS ABBREVIATIONS** or standard international abbreviations cannot be used to create author-defined abbreviations (e.g., $t =$ metric ton and cannot be used as an abbreviation for time, temperature, or treatment; $C =$ carbon and cannot be used for Control).

Once defined, author-defined abbreviations should always be used, except to begin a sentence. Author-defined abbreviations must be defined in the abstract and redefined at first use in the body of the manuscript, in each table, and in each figure. Authors should avoid excessive use of author-defined abbreviations.

**Gene and Protein Names.** Because there is no universally accepted style for gene and protein names that applies to all species, the *JAS* asks authors to assume the responsibility of using the convention appropriate for the particular species. Some general guidelines can be found in the *CSE Manual for Authors, Editors, and Publishers* (7th ed., 2006). For example, the gene that codes for the protein p53 is *TP53* in humans and *Tp53* in mice (note that, by convention, gene names are italicized, and protein names are generally not italicized).

**Quantitative Trait Loci and DNA Markers and Microarray Data.** Authors of papers that contain original quantitative trait loci (QTL) or DNA marker-association results for livestock are strongly encouraged to make their data available in an electronic form to one of the publicly available livestock QTL databases after the manuscript appears on the *JAS First Look* website (http://www.animalsciencepublications.org/publications/jas/first-look). The date on which the paper is posted to the *JAS*-Papers in Press website may represent the official public disclosure date for the contents of the article. Current QTL databases for livestock include, but may not be limited to, the Animal QTL database (http://www.animalgenome.org/QTLdb) and the Bovine QTL database (http://genomes.sacra.edu.au/bovineqlt/index.html). Similarly, for microarray data we request that all authors using microarray data analysis in their research submit a complete data set to 1 of 3 databases before submission of a manuscript: the NCBI Gene Expression Omnibus (GEO; http://www.ncbi.nlm.nih.gov/projects/geo), the EMBL-EBI ArrayExpress repository (http://www.ebi.ac.uk/arrayexpress), or the Center for Information Biology Gene Expression (CIBEX) database.

**Commercial Products.** The use of names of commercial products should be minimized. When a commercial product is used as part of an experiment, the manufacturer name and location (city and state if in the US; city, administrative region or district [e.g., province], and country if outside the US) or a website address must be given parenthetically at first mention in text, tables, and figures. The generic name should be used subsequently. No TM, ®, or © symbols should be used.

**General Usage.**

- Abbreviations are not used to begin sentences. Words must be spelled out
- Note that “and/or” is allowed but not preferred; we ask that authors choose the more appropriate meaning or use “x or y or both” if possible.
- “Sex” should be used, rather than “gender.” Gender is more appropriate for describing a role in society than for describing biological sex.
- State total sample size (e.g., the study included a total of 600 animals), rather than using “N” to represent total sample size.
- In writing, however, a parenthetical remark within a parenthetical is punctuated as brackets within parentheses, ( [ ] ). For example, “The title page includes a running head (no more than 45 keystrokes [i.e., characters plus spaces]); the title...”
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- Meat shear force should be expressed in kilograms (kg), although newtons (N) may also be acceptable.
- Report time using the 24-h system (e.g., 1410 h rather than 2:10 p.m.).
- Use italics to designate genus and species (e.g., *Bos taurus*) and botanical varieties (e.g., *Medicago sativa* var. Potomac). Designations for botanical cultivars should be preceded by “cv.” or enclosed in single quotes (e.g., *Festuca arundinacea* cv. Kentucky 31 or *Festuca arundinacea* ‘Kentucky 31’).
- Names of muscles are not italicized.
- Specify the basis (i.e., as-fed or dry matter) for dietary ingredient and chemical composition data listed in text or in tables. Similarly, specify the basis for tissue composition data (e.g., wet or dry basis).
- Calculations of efficiency should be expressed as output divided by input (i.e., gain:feed, not feed:gain). This avoids the spurious positive and negative infinity values when body weight gain is zero or negative. It also avoids the confusion associated with discussing an improvement as being a decrease.
- A diet is a feedstuff or a mixture of feedstuffs; a ration is the daily allotment of the diet.
- Restrict the use of “while” and “since” to meanings related to time. Appropriate substitutes include “and,” “but,” or “whereas” for “while,” and “because,” “even though,” or “although” for “since.”
- The word “Table” is capitalized and never abbreviated.
- Except to begin a sentence, the word “Figure” should be abbreviated to “Fig.”
- Except to begin a sentence, experiment and equation should be abbreviated to Exp. and Eq., respectively, when preceding a numeral (e.g., Exp. 1).
- Avoid jargon unfamiliar to scientists from other disciplines. Do not use the term “head” to refer to an animal or group of animals. Instead, use animal, sow, ewe, steer, heifer, cattle, etc.
- Avoid bi- as a prefix because of its ambiguity; bi-weekly means twice per week and once every 2 weeks.
- Breed and variety names should be capitalized (e.g., Landrace and Hereford).
- Trademarked or registered names should be capitalized, but no ™ or ® symbols should be used.

II. POLICIES AND PROCEDURES OF JAS

The mission of the American Society of Animal Science (ASAS) is to “foster the discovery, sharing, and application of scientific knowledge concerning the responsible use of animals to enhance human life and well-being” (https://asas.org/about-asas/history-and-mission). The *Journal of Animal Science*, which is published monthly by ASAS, accepts manuscripts presenting information for publication with this mission in mind.

The *JAS* is divided into the following Sections: Animal Genetics; Animal Nutrition: Nonruminant Nutrition; Animal Nutrition: Ruminant Nutrition; Animal Physiology; Animal Production; Animal Products; Special Topics; and Symposia, which contains invited manuscripts from symposia at ASAS meetings. Manuscripts that do not fit one of the *JAS* Sections will not be considered for publication.

The Editor-in-Chief, Managing Editor, and Section Editors establish the editorial policies of JAS, subject to review by the publications committee and ASAS Board of Directors. The views expressed in articles published in *JAS* represent the opinions of the author(s) and do not necessarily reflect the official policy of the institution with which an author is affiliated, the ASAS, or the *JAS* Editor-in-Chief. Authors are responsible for ensuring the accuracy of collection, analysis, and interpretation of data in manuscripts and ultimately for guaranteeing the veracity of the contents of articles published in *JAS*.

The *JAS* is one of the most frequently cited, peer-reviewed, agriculturally oriented research journals in the world, based on statistics published by Thomson Reuters (formerly ISI Inc.; Philadelphia, PA). Its high ranking in several categories attests to the quality standards of the *JAS* editors, editorial board, and staff and the authors who submit manuscripts for publication.

Contact Information

For information on the scientific content of the journal, contact the Editor-in-Chief, Dr. Gregory S. Lewis, American Society of Animal Science, P.O. Box 7410, Champaign, Illinois 61826-7410; e-mail: glewis@asas.org.

For questions about submitting a manuscript and ScholarOne Manuscripts, contact Mr. Brett Holte, Submission Services Manager; e-mail: bholt@sciencesocieties.org.

For assistance with author proofs, contact Ms. Emily Mueller, Managing Editor; e-mail: emueller@sciencesocieties.org.

Care and Use of Animals

All authors submitting to *JAS* must complete the Care and Use of Animals form certifying that any research that involves animals has followed established standards for the humane care and use of animals and must specify which standards were used. Only investigations that have followed high standards for the humane care and use of animals in research will be reported in *JAS*.

Also, the manuscript must include a statement of institutional animal care and use committee (IACUC), or equivalent, approval of all animal procedures. The IACUC statement should appear as the first item in MATERIALS AND METHODS and should specify which publicly available animal care and use standards were followed (e.g., FASS Guide for the Care and Use of Agricultural Animals in Research and Teaching; Primary Industries Ministerial Council, Model code of practice for the welfare of animals: the sheep). The manuscript should describe anesthetics, analgesics, tranquilizers, and care taken to minimize pain and discomfort during preoperative, operative, and postoperative procedures. If research requires discomfort to the animals or stress-
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**Protection of Human Subjects**

In the United States, federally funded or regulated research involving human subjects must comply with Code of Federal Regulations (CFR), Title 45 Public Welfare, Part 46 Protection of Human Subjects. However, CFR 45 Part 46.101(b) exempts some research from these regulations. For all exempted research and other details, see <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html>. Exempted research includes that in which the only involvement of human subjects is for “taste and food quality evaluation and consumer acceptance if 1) wholesome foods without additives are consumed or 2) a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.” If human subjects were used in exempted research and the research was in compliance with CFR 45 Part 46, or equivalent regulations where the research was conducted, authors must state in MATERIALS AND METHODS or acknowledgements that they were in full compliance. If human subjects were used in research that was not exempted in CFR 45 Part 46, or equivalent regulations where the research was conducted, authors must certify that the research received a priori approval from an appropriate Institutional Review Board.

**Conflict of Interest**

All JAS editors, ASAS staff, ASAS Board of Directors, and submitting authors must disclose any actual or potential conflicts of interest that may affect their ability to objectively present or review research or data. This generally includes any relevant professional, personal, political, intellectual, religious, or financial interest in, or relationship with, an individual or business that could have an actual or perceived influence, positive or negative, on the conduct and publication of the research or data. Financial relationships generally refer to financial benefits accruing to authors through avenues such as salary, consulting fees, honoraria (including paid holidays, use of vacation property, country club privileges, and other nonmonetary rewards for service), intellectual property rights, royalties, business ownership, and investments, other than diversified mutual funds or the equivalent.

Disclosures for JAS authors are to be provided as an acknowledgement on the title page of a manuscript (for instructions, see Title Page). The JAS may use such information as a basis for editorial and publication decisions, and may publish such disclosures if that is deemed relevant and sufficient. The JAS editors, ASAS staff, and ASAS Board of Directors with actual or potential conflicts of interest that may affect their ability to objectively evaluate or manage a manuscript will be prevented from gaining access to the manuscript and associated documents, unless they are an author or co-author, in which case ScholarOne Manuscripts will limit their access to the Corresponding Author Center. When the current Editor-in-Chief, for example, has an actual or potential conflict of interest with a manuscript, a former Editor-in-Chief will assume the responsibilities of the Editor-in-Chief for that manuscript.

**Types of Articles**

Articles published in *JAS* encompass a broad range of research topics in animal production and fundamental aspects of genetics, nutrition, physiology, and preparation and utilization of animal products. Many articles are multidisciplinary and cannot be conveniently categorized. Articles typically report research with cattle, goats, pigs, and sheep. However, studies involving other farm animals (e.g., poultry and meat and working horses) and companion animals, including performance and recreational horses, aquatic, and wildlife species will be considered for publication. Studies with laboratory animal species that address fundamental questions related to the biology of livestock, companion animals, and other managed animals may be considered. Manuscripts that report research on production issues in animals other than those constituting the main focus of *JAS* should be submitted to other journals.

The preceding paragraph is not meant to exclude manuscripts but, rather, is a clarification of the focus of *JAS*. Authors may contact the Editor-in-Chief if there are questions about whether the topic of a manuscript is appropriate for *JAS*.

**Research Articles.** Results of research contained in manuscripts submitted to *JAS* must not have been published in or submitted previously to a peer-reviewed scientific journal. Previous presentation at a scientific meeting or the use of data in field-day reports or similar documents, including press publications or postings to personal or departmental websites, do not preclude the publication of such data in *JAS*. However, abstracts, proceedings papers, field-day reports, or similar presentations that are expanded to produce full-length manuscripts should be referenced and cited in *JAS* manuscripts. Articles simultaneously posted to websites and submitted to *JAS* should carry a disclaimer on the website that this version of the paper has not undergone *JAS* peer-review and is not to be considered the final published form of the article. If the article has been published in *JAS*, the author should include the complete *JAS* citation so that proper credit can be given to *JAS* as the publisher of the article. Because *JAS* holds the copyright to articles it publishes, posting altered *JAS* articles that are represented as exact duplicates of the published version constitutes copyright violation.

**Review Articles.** The journal publishes invited review articles. The Editor-in-Chief, in consultation with Section Editors and the ASAS Board of Directors, identifies invited reviews. Section Editors may solicit proposals for review articles to be published in *JAS*, after consultation with and approval by the Editor-in-Chief; the authors may be responsible for a portion of the publication charges for invited reviews. Unsolicited review
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Special Topics. This Section includes Biographical or Historical Sketches and Contemporary Issues in the animal sciences. Even though Biographical or Historical Sketches are part of the Special Topics Section, they will be published on the ASAS website and in the Association News section of JAS. The frequency of publication depends on the availability of the prepared sketches. For more information, see http://www.animalsciencepublications.org/publications/jas/infora..

Contemporary Issues include topics such as environmental concerns, legislative proposals, systems analysis, and various “newsworthy” scientific issues. Even though Contemporary Issues manuscripts do not have to include original data, authors’ assertions should be substantiated with references to established information from credible published sources.

Special Topics papers will be subject to peer review in a manner similar to other JAS submissions. Because of the nature of these manuscripts, their format may vary from that of standard scientific articles, although ABSTRACT and INTRODUCTION must be consistent with keystroke (characters and spaces) limitations defined earlier in this document.

Teaching articles should be submitted to Natural Sciences Education, which is a joint venture of several professional societies, including the ASAS. Articles in Natural Sciences Education are “written by and for educators in extension, universities, industry, administration, and grades K–12” and highlight teaching techniques, concepts, ideas, and other teaching-related issues. The goal is to build a portfolio of teaching-related articles that can be accessed at a single location. For detailed information about Natural Sciences Education, see https://www.agronomy.org/publications/nse.

Technical Notes. A technical note is used to report a new method, technique, or procedure of interest to JAS readers. When possible, a technical note should include a comparison of results from the new method with those from previous methods, using appropriate statistical tests. The advantages and disadvantages of the new procedure should be discussed. When typeset for publication, a technical note shall not exceed 8 pages (approximately 12 Microsoft Word document pages), including tables and figures. “Technical note:” shall be the first portion of the title of such manuscripts. The review process for a technical note will be the same as that for other manuscripts. Information that is more extensive or detailed than necessary for a Technical note may be presented in an e-supplement (see E-Supplements). Short communications, brief communications, and similar types of articles will not be considered for publication in JAS.

Letters to the Editor. A letter judged suitable for publication will be printed in a “Letters to the Editor” section of JAS. The purpose of this section is to provide a forum for scientific exchange relating to articles published in JAS. To be acceptable for publication, a letter must adhere to the following guidelines. 1) Only a letter that addresses matters of science and relates to information published in JAS will be considered. In general, a letter should not exceed 5,000 keystrokes and should contain no more than 5 citations. 2) A letter should provide supporting evidence based on published data for the points made or must develop logical scientific hypotheses. A letter based on conjecture or unsubstantiated claims will not normally be published. No new data may be presented in a letter. 3) The Editor-in-Chief will evaluate each letter and determine whether a letter is appropriate for publication. If a letter is considered appropriate, the author(s) of original JAS article(s) will be invited to write a letter of response. Normally both letters will be published together. 4) All letters will be subject to acceptance and editing by the Editor-in-Chief and editing by a technical editor.

SUBMISSION OF MANUSCRIPTS

Manuscripts must be submitted electronically through ScholarOne Manuscripts at http://mc.manuscriptcentral.com/jas. Authors with questions about using the electronic manuscript submission system or, for technological reasons, are unable to submit manuscripts electronically may contact Mr. Brett Holte (bholte@sciencesocieties.org).

Copyright Agreement

Authors shall complete the Manuscript Submission and Copyright Release form for each new manuscript submission. The form is completed during the submission process through ScholarOne Manuscripts. Authors, such as United States government employees, who are unable to grant copyright to ASAS must indicate the reason for exemption on the form; material that was produced as an official duty of a U.S. Government employee is considered public domain. The American Society of Animal Science holds the copyright to material published in JAS. Persons who wish to reproduce material in JAS must request written permission to reprint copyrighted information from the Managing Editor, Ms. Emily Mueller (emueller@sciencesocieties.org). Likewise, authors of JAS manuscripts who include material (usually tables or figures) taken from other copyrighted sources must secure permission from the copyright holders and provide evidence of this permission at the time the manuscript is submitted to JAS for review. Tables or figures reproduced from the work of others, or data extracted from the work of others and used to construct summary tables (or figures) for meta-analyses, must include an acknowledgement of the original source in a footnote or legend and, when appropriate, a complete citation in LITERATURE CITED. The ASAS, however, grants to the author(s) of JAS articles the right of republication in any book of which he or she is author or editor, subject only to his or her giving proper credit in the book to the original JAS publication of the article by ASAS.

REVIEW OF MANUSCRIPTS

General Procedures. The Editor-in-Chief and Section Editors determine whether manuscripts are suitable for publication in JAS. All communications about a submitted manuscript should maintain confidentiality. Section Editors handle correspondence with the peer re-
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**Editors.** A manuscript is reviewed by at least one Section Editor. The Editor responsible for the manuscript (Section Editor, Associate Editor, or Editor-in-Chief) may ask for the review of other reviewers. The authors have the right to request the identity of the reviewers and to appeal the recommendation of the Editor along with all reviewers’ comments to the Section Editor or Editor-in-Chief. A manuscript that is not accepted may be resubmitted to the Editor-in-Chief. The Editor-in-Chief may reassign the manuscript to a new Section Editor who then assigns it to other appropriate reviewers. The Editor-in-Chief may also require the submission of a revised version or recommend that the manuscript be withdrawn. The Editor-in-Chief may also request that a new Section Editor be assigned to the manuscript, and, if necessary, consult with the Section Editor responsible for the manuscript. Decisions of the Editor-in-Chief are final; the Editors do not appeal these decisions.

**Appeals.** If a manuscript is rejected, as a first course of action, the author should discuss the matter with the Section Editor responsible for the manuscript. Decisions must be appealed to the Editor-in-Chief if the author(s) believe(s) that the judgment was erroneous or biased. A letter presenting the reasons for the appeal should be sent to the Editor-in-Chief. The Editor-in-Chief will review the author’s reasons, all documents related to the manuscript, and, if necessary, consult with the Section Editor responsible for the manuscript. The Editor-in-Chief will then decide whether to accept or deny the appeal. A rejected manuscript may be resubmitted for publication in another Section of *JAS* only if the Editor-in-Chief recommends this action or if the Section Editor originally assigned to the manuscript has specifically recommended this action and the Editor-in-Chief has approved the transfer.

**Revisions.** Most manuscripts that are eventually accepted for publication are returned to the author(s) at least once for revision. All revised manuscripts must be returned to Section Editors via ScholarOne Manuscripts. Authors will be permitted 15 days to revise and return manuscripts classified as Minor Revision and permitted 35 days to revise and return manuscripts classified as Major Revision. ScholarOne Manuscripts prompts reviewers to classify manuscripts as Minor Revision or Major Revision. Section Editors will use the reviewers’ classifications and their own evaluations to estimate the time required for authors to respond to reviews and use that estimate during the process of classifying manuscripts. A manuscript that will clearly require more than 35 days for revisions may be rejected. However, the author will be invited to revise the manuscript, create a new submission, and reference the original manuscript tracking number (e.g., Manuscript ID E-2015-1234) in the submission letter that accompanies the new submission. Section Editors will use the original reviews and the author’s responses to the original reviews to evaluate the submission. Unless the new submission contains a significant amount of new data, there should be no reason to seek new reviews.

Manuscripts that exceed the revision-option deadline will be withdrawn. Extenuating circumstances may justify the need to extend the revision-option deadline. Requests for extensions must be communicated to the Section Editor responsible for the manuscript before the revision-option expires. The Editor-in-Chief must approve extensions. As a general rule, only one short extension will be approved. The Revision Checklist for Authors is sent with requests for revision (http://www.animalsciencepublications.org/files/publications/jas-revision-checklist.pdf). Authors should closely follow the Checklist.

**PAPERS IN PRESS, AUTHOR PROOFS, AND PUBLICATION CHARGES**

**Papers in Press.** To facilitate earlier disclosure of research results, accepted manuscripts will be assigned a digital object identifier (doi) and posted to the *JAS* First Look site (http://www.animalsciencepublications.org/publications/jas/first-look) in the form in which they are accepted. The authors bear the primary responsibility for the content of manuscripts posted to the Papers in Press site. Because articles posted to this site have not been professionally edited and typeset, and are frequently changed in response to questions from editors, they do not represent the final, published form of the manuscript. The date a complete monthly issue of *JAS* is posted online is the official publication date for *JAS* articles. However, the date on which a manuscript is posted to the *JAS*-Papers in Press website may represent the official public disclosure date for the contents of the article. Authors concerned about intellectual property issues, such as patents and disclosure dates, should seek legal counsel before submitting manuscripts to a scientific journal.

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The following abbreviations should be used without definition in *JAS*. Plural abbreviations do not contain a final “s” because the context of an abbreviation implies whether it is singular or plural. Use of the standard 3-letter abbreviations for amino acids (e.g., Ala) is acceptable in *JAS*. Use of the internationally recognized chemical symbols for chemical elements (e.g., P and S) is acceptable in *JAS*. Except for N (not italicized), which is the recognized abbreviation for nitrogen and newton (unit of force), chemical symbols for elements are reserved for elements (e.g., C is for carbon and never for control). For chemical units and abbreviations, refer to the ACS Style Guide (published by the American Chemical Society, Washington, DC).

**Units of time**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
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<tbody>
<tr>
<td>s</td>
<td>second</td>
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<tr>
<td>min</td>
<td>minute</td>
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<tr>
<td>h</td>
<td>hour</td>
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<tr>
<td>d</td>
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<tr>
<td>wk</td>
<td>week</td>
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<tr>
<td>mo</td>
<td>month</td>
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<tr>
<td>yr</td>
<td>year</td>
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**Statistical symbols and abbreviations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANOVA</td>
<td>analysis of variance</td>
</tr>
<tr>
<td>CI</td>
<td>confidence interval</td>
</tr>
<tr>
<td>CV</td>
<td>coefficient of variation</td>
</tr>
</tbody>
</table>

**Physical units**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bq</td>
<td>becquerel</td>
</tr>
<tr>
<td>°C</td>
<td>degree Celsius</td>
</tr>
<tr>
<td>cal</td>
<td>calorie</td>
</tr>
<tr>
<td>Ci</td>
<td>curie</td>
</tr>
<tr>
<td>cM</td>
<td>centimorgan (spell out morgan if used without a prefix)</td>
</tr>
<tr>
<td>Da</td>
<td>dalton</td>
</tr>
<tr>
<td>Eq</td>
<td>equivalent (only can be used with a prefix; e.g., mEq)</td>
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<tr>
<td>g</td>
<td>gram</td>
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<tr>
<td>ha</td>
<td>hectare</td>
</tr>
<tr>
<td>Hz</td>
<td>hertz</td>
</tr>
<tr>
<td>IU</td>
<td>international unit</td>
</tr>
<tr>
<td>J</td>
<td>joule</td>
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<tr>
<td>L</td>
<td>liter</td>
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<tr>
<td>lx</td>
<td>lux</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>M</td>
<td>molar (concentration; preferred over mol/L)</td>
</tr>
<tr>
<td>mol</td>
<td>mole</td>
</tr>
<tr>
<td>N</td>
<td>newton (N not italicized)</td>
</tr>
<tr>
<td>N</td>
<td>normal (concentration)</td>
</tr>
<tr>
<td>Pa</td>
<td>pascal</td>
</tr>
<tr>
<td>rpm</td>
<td>revolutions/minute (not to be used to indicate centrifugal force)</td>
</tr>
<tr>
<td>t</td>
<td>metric ton (1,000 kg)</td>
</tr>
<tr>
<td>V</td>
<td>volt</td>
</tr>
<tr>
<td>W</td>
<td>watt</td>
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</tbody>
</table>
Instructions for Authors of *Journal of Animal Science*

**df** degree(s) of freedom (spell out if used without units)
**F** *F*-distribution (variance ratio)
**LSD** least significant difference
**n** sample size (used parenthetically or in footnotes; note italics)
**P** probability
**r** simple correlation coefficient
**r²** simple coefficient of determination
**R** multiple correlation coefficient
**R²** multiple coefficient of determination
**s²** variance (sample)
**SD** standard deviation (sample)
**SE** standard error
**SED** standard error of the differences of means
**SEM** standard error of the mean
**t** *t*-(or Student) distribution
**α** probability of Type I error
**β** probability of Type II error
**μ** mean (population)
**σ** standard deviation (population)
**σ²** variance (population)
**χ²** chi-squared distribution

**BTA** *Bos taurus* chromosome
**BW** body weight (used for live weight)
**cDNA** complementary deoxyribonucleic acid
**C/EBP** CAAT-enhancer binding protein
**cfu** colony-forming unit
**CIE** International Commission on Illumination (Commission Internationale d’Eclairage)
**CLA** conjugated linoleic acid
**CoA** coenzyme A
**Co-EDTA** cobalt ethylenediaminetetraacetate
**CP** crude protein (N × 6.25)
**D** dextro-
diam. diameter
**DE** digestible energy
**DEAE** (dimethylamino)ethyl (as in DEAE-cellulose)
**DFD** dark, firm, and dry (meat)
**DM** dry matter
**DMI** dry matter intake
**DNA** deoxyribonucleic acid
**EBV** estimated breeding value(s)
**eCG** equine chorionic gonadotropin
**EDTA** ethylenediaminetetraacetic acid
**EFA** essential fatty acid
**EIA** enzymeimmunoassay
**ELISA** enzyme-linked immunosorbent assay
**EPD** expected progeny difference(s)
**Eq.** Equation(s)
**Exp.** experiment (always followed by a numeral)
**FFA** free fatty acid(s)
**FSH** follicle-stimulating hormone
**GEBV** genomic estimated breeding value(s)
**g** gravity
**GE** gross energy
**G:F** gain-to-feed ratio
**GLC** gas-liquid chromatography
**GLM** general linear model
**GnRH** gonadotropin-releasing hormone
**GH** growth hormone
**GHRH** growth hormone-releasing hormone
**h²** heritability
**i.m.** intramuscular
**i.p.** intraperitoneal
**i.v.** intravenous
**hCG** human chorionic gonadotropin
**HCW** hot carcass weight

**Others**

<table>
<thead>
<tr>
<th>Item</th>
<th>Term</th>
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</thead>
<tbody>
<tr>
<td>AA</td>
<td>amino acid(s)</td>
</tr>
<tr>
<td>ACTH</td>
<td>adrenocorticotropic hormone</td>
</tr>
<tr>
<td>ADF</td>
<td>acid detergent fiber (assumed sequential unless designated otherwise)</td>
</tr>
<tr>
<td>ADFI</td>
<td>average daily feed intake (not to be confused with DMI)</td>
</tr>
<tr>
<td>ADG</td>
<td>average daily gain</td>
</tr>
<tr>
<td>ADIN</td>
<td>acid detergent insoluble nitrogen</td>
</tr>
<tr>
<td>ADL</td>
<td>acid detergent lignin</td>
</tr>
<tr>
<td>ADP</td>
<td>adenosine diphosphate</td>
</tr>
<tr>
<td>AI</td>
<td>artificial insemination</td>
</tr>
<tr>
<td>AIA</td>
<td>acid insoluble ash</td>
</tr>
<tr>
<td>ARS</td>
<td>Agricultural Research Service</td>
</tr>
<tr>
<td>ATP</td>
<td>adenosine triphosphate</td>
</tr>
<tr>
<td>avg</td>
<td>average (use only in tables, not in the text)</td>
</tr>
<tr>
<td>BCS</td>
<td>body condition score</td>
</tr>
<tr>
<td>BLUE</td>
<td>best linear unbiased estimate</td>
</tr>
<tr>
<td>BLUP</td>
<td>best linear unbiased prediction</td>
</tr>
<tr>
<td>bp</td>
<td>base pair</td>
</tr>
<tr>
<td>BSA</td>
<td>bovine serum albumin</td>
</tr>
</tbody>
</table>
HEPES  \(N\cdot(2\text{-hydroxyethyl})\text{piperazine}-N'\cdot2\text{-ethanesulfonic acid}\)

HPLC high-performance (pressure) liquid chromatography

i.d. inside diameter

Ig immunoglobulin (when used to identify a specific immunoglobulin)

IGF insulin-like growth factor

IGFBP insulin-like growth factor-binding protein(s)

IL interleukin

IVDMD in vitro dry matter disappearance

kb kilobase(s)

KPH kidney, pelvic, heart fat

L levo-

LD\(_{50}\) lethal dose 50%

LH luteinizing hormone

LHRH luteinizing hormone-releasing hormone

LM longissimus muscle

ME metabolizable energy

MP metabolizable protein

mRNA messenger ribonucleic acid

MUFA monounsaturated fatty acid

NAD nicotinamide adenine dinucleotide

NADH reduced form of NAD

NDF neutral detergent fiber

NDIN neutral detergent insoluble nitrogen

NE net energy

NE\(_g\) net energy for gain

NE\(_l\) net energy for lactation

NE\(_m\) net energy for maintenance

NEFA nonesterified fatty acid

No. number (use only in tables, not in the text)

NPN nonprotein nitrogen

NRC National Research Council

OIE World Organisation for Animal Health (Office International des Epizooties)

OM organic matter

PAGE polyacrylamide gel electrophoresis

PBS phosphate-buffered saline

PCR polymerase chain reaction

PG prostaglandin

PGF\(_{2\alpha}\) prostaglandin F\(_{2\alpha}\)

PMSG pregnant mare's serum gonadotropin

PPAR peroxisome proliferator-activated receptor

PSE pale, soft, and exudative (meat)

PUFA polyunsaturated fatty acid(s)

QTL quantitative trait locus (loci)

RDP ruminally degradable protein

REML restricted maximum likelihood

RFLP restriction fragment length polymorphism

RIA radioimmunoassay

RNA ribonucleic acid

RQ respiratory quotient

RUP ruminally undegradable protein

rRNA ribosomal ribonucleic acid

SAS SAS Institute Inc. (no longer stands for Statistical Analysis System)

s.c. subcutaneous

SDS sodium dodecyl sulfate

SFA saturated fatty acid

SNP single nucleotide polymorphism

spp. species

ssp. subspecies

SSC \(Sus\ scrofa\) chromosome

ST somatotropin

TDN total digestible nutrients

TLC thin layer chromatography

Tris tris(hydroxymethyl)aminomethane

tRNA transfer ribonucleic acid

TSAA total sulfur amino acids

USDA US Department of Agriculture

UV ultraviolet

VFA volatile fatty acid(s)

vol volume

vol/vol volume/volume (used only in parentheses)

vs. versus

wt weight (use only in tables, not in the text)

wt/vol weight/volume (used only in parentheses)

wt/wt weight/weight (used only in parentheses)

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LITERATURE CITED GUIDELINES FOR JOURNAL OF ANIMAL SCIENCE

References in the Text. In the body of the manuscript, refer to authors as follows: Smith and Jones (1992) or Smith and Jones (1990, 1992). If the sentence structure requires the authors’ names to be included in parentheses, the proper format is (Smith and Jones, 1982; Jones, 1988a,b; Jones et al., 1992, 1993). When there are more than 2 authors of an article, the first author’s name is
followed by the abbreviation et al. More than 1 article listed in the same sentence or parentheses must be in chronological order first and alphabetical order for 2 publications in the same year. Published, peer-reviewed articles, and not abstracts, should be cited. However, if authors originally described their work in a meeting abstract, proceedings paper, field-day report, or similar presentation and then expanded the information to produce a full-length manuscript, the authors should reference and cite those reports. If the work was someone else’s and originally described in an abstract, proceedings paper, field-day report, or similar presentation, the authors should determine whether the work has been expanded and published as a peer-reviewed article, and then reference and cite the peer-reviewed article.

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Sample references are as follows:

1. **Books and articles within edited books:**

2. **Handbooks, technical bulletins, theses, and dissertations**


3. **Journal articles and abstracts**
   doi 10.1126/science.1167936

4. **Conference proceedings**

5. Electronic Publications
FDA. 2014. Approved animal drug products online (Green Book). http://www.fda.gov/AnimalVeterinary/Products/ApprovedAnimalDrugProducts/default.htm (Accessed 26 December 2014.)

POLICIES REGARDING NUMBER USAGE FOR JOURNAL OF ANIMAL SCIENCE
Number usage in JAS is consistent with the Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers.

- All cardinal numbers are written as numerals except when they begin a sentence or appear in a title, when 2 numerals are adjacent in a sentence (spell out the number most easily expressed in words; e.g., two 10-kg samples), or when a number is used as a figure of speech.
- Numbers less than 1 are written with a preceding (leading) zero (e.g., 0.75).
- A comma separator is used in numbers greater than 999 (e.g., 1,234 and 1,234,567).
- Numerals should be used to designate ratios and multiplication factors (e.g., 2:1 and 3-fold increase).
- Statements such as “5 times less” should be avoided because “times” means multiplied by, and the product of a positive number (multiplicand) multiplied by 5, for example, is greater, not less, than the multiplicand. The opposite is true for a negative multiplicand, but the notion of “5 times less than –5,” for example, may be not be clear to readers.
- If a number is spelled out at the beginning of a sentence, its associated unit is also spelled out (e.g., Ten microliters of fluid . . ., not Ten μL of fluid . . ).
- Units of measurement not associated with a number should be spelled out rather than abbreviated (e.g., lysine content was measured in milligrams per kilogram of diet) unless used parenthetically, as “lysine content (mg/kg of diet) was measured,” or in tables and figures.
- Single-digit ordinals are spelled out (i.e., first through ninth); larger ordinals are expressed in numeric form. Single-digit ordinals may be expressed numerically when they form part of a series (e.g., 1st, 3rd, 10th, 20th, not first, third, 10th, and 20th).
- Measures must be presented in the metric system (SI or Système International d’Unités; see http://physics.nist.gov/cuu/Units/introduction.html.
- When a term must be expressed in nonmetric units for clarity (e.g., bushel weight), show the nonmetric value in parentheses immediately after the metric value.
- Use “to” instead of a hyphen to indicate a numerical range in text (e.g., 1 to 10).
- Avoid the use of multiplying factors (e.g., × 10⁻⁶) in table columns or rows, or in figure axis labels because of the uncertainty about whether the data are to be, or already have been, multiplied by the factor.
- Avoid ambiguity by stating units (e.g., numbers of spermatozoa, millions/mL).
- Do not use more than one slant line (for “per”) in a single expression; for example, use 5 mg/(g ∙ d) or 5 mg ∙ g⁻¹ ∙ d⁻¹ instead of 5 mg/g/d. Mathematically, “per” implies division; when 2 “per” occur consecutively, it is unclear precisely what is being divided by what.
- Dietary energy may be expressed in calories or in joules, although joule is the standard SI unit for energy.
- Hyphenate units of measure used as preceding adjectives (e.g., 5-kg sample). Hyphens are not used with percent or degree signs.
- Insert spaces around all signs (except slant lines) of operation when these signs occur between 2 values (e.g., 10 ± 1; 5 < 10; 2 + 2 = 4).
- Convert “mg %” to other units, such as mg/L or mg/mL.
- Use “mol/100 mol” rather than “molar percent.”.