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. Manufacturer information must be provided at the first mention of each proprietary product used in the research (for details see, *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. Author-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, Ingredient, Trait, Fatty acid). Units (e.g., kg) should be separated from headings by a comma, rather than being shown in parentheses. Limit the data field to the minimum needed for meaningful comparison within the accuracy of the methods. In the body of the table, numerals are used to reference footnotes. Each footnote should begin on a new line. Lowercase, superscript letters are used to indicate significant differences among means within a row or column and to reference footnotes explaining how to interpret the letters.

Figures should follow the Quality Guidelines for *Journal of Animal Science (JAS)* Figures (http://www.animalsciencepublications.org/files/pub-
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Figure captions should be typed double-spaced on a separate page. Now that *JAS* is a fully electronic publication, authors are encouraged to use color to enhance figures; there are no additional fees for color figures and images in issues of *JAS*.

Individuals may purchase print-on-demand copies of *JAS* issues from Sheridan Press. Print-on-demand copies will contain gray-scale, rather than color, figures and images. To purchase these, contact Sheridan at *Journal of Animal Science* or American Society of Animal Science, PO Box 465, Hanover, PA 17331 P: 717-632-3535, F: 717-633-8920, E: pubsvc.tsp@sheridan.com.

**Appendices.** An appendix or appendices are optional and used to provide numerical examples or give extensive detail of analytical procedures. However, if the supplemental material is of interest only to a limited number of *JAS* readers, it should not be included as an appendix. Instead, state that supplemental information is available on request from the corresponding author; addresses for websites with appropriate supplemental information are acceptable. If extensive, the data may be included as an e-supplement to the manuscript (see **E-Supplements**). Appendices should follow LITERATURE CITED and be introduced with a major heading (e.g., **APPENDIX 1: TITLE**).

**E-Supplements.** Authors may present material in an e-supplement (e.g., detailed data sets, Excel files, and video) that is more extensive or detailed than necessary for a *JAS* article. A note will appear in the *JAS* article that more material can be found online. Material in an e-supplement must undergo peer review and, thus, should be in a format that is easily accessible (i.e., does not require dedicated software or software that is not generally available) to most reviewers and readers.

**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 Trp53 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.sacaff.edu.au/bovineqtl/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 ™, ®, 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 math, the hierarchy for brackets and parentheses is [ ( ) ]. For example, [(2 + 3) × (12 ÷ 2)] × 2 = 60.
- 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: bholte@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 publically 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-
ful conditions, justification for these conditions must be evident in papers published in JAS.

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 accrued 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 coau-thor, 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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articles will not be considered.

**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.animalsciencenewspublications.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 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 should 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) or 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-
viewers and corresponding author and promptly decide whether a manuscript should be accepted, revised, or rejected. A Section Editor's decision to accept, invite revision, or reject a manuscript after peer review is based on peer-reviewer comments and recommendations and the Section Editor's own review of the manuscript. Section Editors forward document files for accepted and rejected manuscripts to the Editor-in-Chief. After acceptance, manuscript files are forwarded to the technical editors. The Editor-in-Chief is the final arbiter concerning acceptance or rejection of manuscripts submitted for publication.

Rejections. Manuscripts are rejected for 3 general reasons. 1) The substance of the manuscript may not meet JAS standards; the work may be incomplete, the evidence may not support the conclusions, the experimental approach may be poorly conceived, or the work may repeat established fact or represent no advancement of the existing knowledge. 2) Even though the work may be sound and the results valid, the paper may be better suited for publication elsewhere. 3) Manuscripts are not written clearly, concisely, and coherently, or they are not consistent with guidelines in the 2015 Instructions for Authors, Journal of Animal Science. These manuscripts may be rejected without review. Authors whose first language is not English are urged to have an editing service review their manuscripts before they are submitted to JAS. However, JAS considers the authors, and not an editing service, responsible for the content of manuscripts.

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 JAS 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-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.

Author Proofs. Accepted manuscripts are forwarded to the editorial office for technical editing and typesetting. During this process, the technical editor may contact the authors for missing information or figure revisions. The manuscript is then typeset, figures reproduced, and author proofs (also called galley proofs) prepared. Correspondence concerning the accepted manuscript should be directed to the technical editor.

Proofs of all manuscripts will be provided to the corresponding author and should be read carefully and checked against the typed manuscript. Accuracy of the author proof is the sole responsibility of the author(s). Corrections may be returned by e-mail (preferred), fax, or overnight mail. For faxed or mailed corrections, changes to the proof should be made neatly and clearly in the margins of the proof. If extensive correction is required, changes should be provided on a separate sheet of paper with a symbol indicating location on the proof.
Instructions for Authors of *Journal of Animal Science*

Changes e-mailed to the technical editor must indicate page, column, and line numbers for each correction to be made on the proof. Notes created with Adobe editing tools and pointing to specific locations for corrections may also be used. Editor queries should be answered on the galley proofs; failure to do so may delay or prevent publication. Excessive author changes made at the proof stage may result in a $250 surcharge for additional typesetting, and they may be deemed so excessive that the manuscript will be returned to the Section Editor for additional scientific review.

**Publication Charges and Reprints.** The journal has 2 options available for publication: open access and conventional page charges. For the open access option, authors will pay the open access fee when proofs are returned to the editorial office so that their article will become freely available upon publication in an online issue of *JAS*. Charges for open access publication are $2,500 per article if at least one author is a current professional member of ASAS; the charge is $3,250 when no author is a professional ASAS member. For conventional publication, the charge is $85 per printed page in *JAS* if at least one author is a professional ASAS member; the page charge is $170 when no author is a professional member of ASAS. Reprints may be ordered at an additional charge.

Professional membership in ASAS is available to any person who has research, educational, commercial, or administrative responsibilities or interests in the broad disciplines within animal science. Annual professional membership is $135, and the complete details are available at the following website: [https://www.asas.org/membership-services/member-information](https://www.asas.org/membership-services/member-information).

When the author proof is sent, the author is asked to complete a reprint order form requesting the number of reprints desired and the name of the institution, agency, or individual responsible for publication charges. Now that *JAS* is a fully electronic publication, there are no additional charges for color figures and images that appear in electronic issues of *JAS*. However, authors who order reprints are responsible for paying any additional charges for printing reprints that contain color.

### STANDARD JAS ABBREVIATIONS

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).

<table>
<thead>
<tr>
<th>Physical units</th>
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<tr>
<td>Item</td>
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<tr>
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<tr>
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<tr>
<td>Ci</td>
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<td>cM</td>
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<td>Da</td>
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<tr>
<td>V</td>
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### Units of time

<table>
<thead>
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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>
<td>day</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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</tbody>
</table>

### 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>
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

Others

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

**HEPES** | $N^\prime$(2-hydroxyethyl)piperazine-$N^\prime$-2-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
**o.d.** | outside diameter
**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
Instructions for Authors of *Journal of Animal Science*

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.

Work that has not been accepted for publication shall be listed in the text as “J. E. Jones (institution, city, and state or country, personal communication)” The author’s own unpublished work should be listed in the text as “(J. Smith, unpublished data)” Personal communications and unpublished data must not be included in the Literature Cited section.

**Literature Cited Section.** To be listed in LITERATURE CITED, articles must be published or accepted for publication (“in press”). In-press citations should be updated with complete information during revision or in the author proofs. In LITERATURE CITED, citations are listed alphabetically according to author(s) last name(s), and then chronologically. The year of publication follows author names. As with text references, 2 or more publications by the same author or set of authors in the same year shall be differentiated by adding lowercase letters after the date. With the exception of consortia, the names of all authors must appear in LITERATURE CITED. For consortia, authors may include, as an acknowledgement on the title page, a link to the website containing the names and locations of the members of the consortium, or they may include the names and locations of the members of the consortium in an appendix, but not in an acknowledgement on the title page. Journal names shall be abbreviated according to the conventional ISO abbreviations used by PubMed (http://www.ncbi.nlm.nih.gov/nlmcatalog/journals). One-word titles must be spelled out. Inclusive page numbers must be provided.

Sample references are as follows:

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

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

3. **Journal articles and abstracts**

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.”.