



Journal of Dairy Science® Instructions to Authors: Style and Form¹

Journal Policies and Procedures

The American Dairy Science Association® (ADSA®) invites scientists from the global community to submit papers for consideration to the *Journal of Dairy Science* (JDS). Authors need not be members of ADSA. These instructions detail editorial policies and style and form for publishing in JDS. We recommend that authors refer to these instructions, as well as the **Instructions to Authors: Policies**, during submission, peer review, acceptance, proof correction, and final publication phases.

Contact Information for Journal Staff

For information on the scientific content of the journal, contact the editor-in-chief, Dr. Matthew C. Lucy; phone: (573) 882-9897; e-mail: lucym@missouri.edu.

For assistance with Scholar One (Manuscript Central) and Manuscript Submission/Copyright forms, contact Shauna Miller, editorial assistant, Headquarters Office, 1800 S. Oak St., Suite 100, Champaign, IL 61820; phone (217) 239-3339; fax (217) 378-4083; shaunam@assoqhq.org.

For questions about manuscript preparation, journal style and form, and proofs, contact Louise Adam, lead technical editor, at loua@assoqhq.org or journals@assoqhq.org.

For other information, contact Susan Pollock, managing editor, Headquarters Office, American Dairy Science Association, 1800 S. Oak St., Suite 100, Champaign, IL 61820; phone (217) 356-7641; journals@assoqhq.org.

Aims and Scope

The *Journal of Dairy Science* publishes original research, invited review articles, and other scholarly work that relates to the production and processing of milk or milk products intended for human consumption. The journal is broadly divided into dairy foods and dairy production sections. The Resources and Environment section may include papers from either Dairy Foods or Dairy Production.

Dairy Foods Sections

- Bioactivity and Human Health
- Chemistry and Materials Science
- Microbiology and Safety
- Processing and Engineering
- Resources and Environment
- Sensory Analysis

Dairy Production Sections

- Animal Nutrition
- Breeding, Genetics, and Genomics
- Health, Behavior, and Well-being
- Management and Economics
- Physiology
- Resources and Environment

In addition to the above sections, interpretive applied summaries and recommendations may be submitted to the Dairy Industry Today section. Syntheses and applications from technical reports that contribute to solutions to problems in the dairy industry are especially solicited. Authors of reports for extension education of the nonscientist are encouraged to share their contributions with colleagues and to achieve wider circulation of their conclusions and recommendations through this section. In addition, papers that report on advances in teaching and outreach techniques are suitable for this section.

Types of Articles

Full-Length Research Papers. The majority of papers published in JDS are full-length research articles. The journal emphasizes the importance of high-quality scientific writing and clarity in presentation of the concepts and methods, and sufficient background information that would be required for thorough understanding by scientists in other disciplines. The results of experiments published in the journal must be replicated, either by replicating treatments within experiments or by repeating experiments. Studies using commercial products should address a hypothesis-based question relevant to the biology or mechanism of action of the product.

In addition to full-length research papers, the following types of articles appear in the journal:

¹Revised January 2016.

Hot Topics. Papers submitted for this section must report on a completed experiment testing a timely, original hypothesis of importance to an area of dairy science. The work may be preliminary in nature, but with sufficient data so that the hypothesis is clearly tested. Results may point to avenues for fruitful, in-depth analyses. Reports must contain an explicitly stated hypothesis and objectives, with sufficient detail in methodology for repetition of the work, as well as results, a brief discussion, and references. Total page limits for text, tables, figures, and references must be no more than 5 journal pages (approximately 10 manuscript pages minus space for tables and figures). Hot topics should not contain main headings or subheadings. The total number of tables and figures should be no more than 3; references should be minimal.

Hot topics papers will be given priority for publication. An effort will be made to notify authors of a decision within 1 mo of the date of receipt. Once accepted, the paper should be published within 3 mo.

Short Communications. Short communications are reports of limited experiments that test a timely, original hypothesis of importance to some area of dairy science. The manuscript should be no more than 5 journal pages in length and the total number of tables and figures should be no more than 3 (approximately 10 manuscript pages minus space for tables and figures); "Short communication:" should precede the title on the title page of the manuscript. Short communications should not contain main headings or subheadings. The manuscript may report negative results. Reports must contain a hypothesis, objectives, sufficient detail in methodology for repetition of the work, results with brief discussion, and references.

Technical Notes. Papers in this section should report a method that is useful to some aspect of dairy science. Submissions should include a brief justification for the technique, be it new or an improvement on a previously published technique. The report should state a hypothesis, include a full description of procedures that can be repeated by researchers, and include explicit controls to indicate sensitivity, precision, and accuracy of the technique. Technical notes should not contain main headings or subheadings.

If the technique is an improvement on an existing technique, sufficient comparison of the previous technique should be included, and mean and dispersion information must be included. The page limit is 5 journal pages (approximately 10 manuscript pages minus space for tables and figures). Use of tables, figures, and references should be minimized. Requests for longer technical notes may be made to the senior editor and

editor-in-chief, but justification for a longer report will be required.

Invited Reviews. The journal publishes invited reviews in all scientific sections of the journal. Authors interested in writing a review should contact the invited reviews editor, Filippo Miglior (miglior@cdn.ca) with justification for the review. The invited reviews editor is responsible for inviting submission of review papers and overseeing the peer-review process. The first 10 printed pages of an invited review are published at no cost to the author.

Letters to the Editor. Short (300 words) letters to the editor on topics of concern to readers, including comment on publications with rebuttals from authors if needed, may be submitted to the editor-in-chief or to any of the editors. The letters should be titled and the title and running head should include "Letter to the editor." Letters will be published at the discretion of the editor-in-chief. Authors of letters are subject to the same copyright release requirements as other authors. Letters are published at no charge to the author(s).

MANUSCRIPT PREPARATION

Writing Style

Papers must be written in English. The text and all supporting materials must use American spelling and usage as given in *Merriam-Webster's Collegiate Dictionary*, 11th ed., *Webster's Third International Dictionary*, or the *New Oxford American English Dictionary*, 3rd ed.

Today, most medical and scientific style manuals support the active over the passive voice. Use of the active voice results in lively, clear, and concise writing. Passive voice may still be appropriate in the Materials and Methods section, for example, where the actor is unimportant and the writer wishes to focus on the action or the recipient of the action. The active voice and first-person pronouns (I, we) should be used in the Results, Discussion, and Conclusions sections. For example, "we observed a difference..." "we concluded that ...," or "Treatment A affected dry matter intake . . ." rather than "There was a difference . . .," "It was concluded that ...," or "Dry matter intake was affected by treatment A ..."

For scientific conventions, authors should follow the style and form recommended in *Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers*, 8th ed., published by the Council of Science Editors in cooperation with University of Chicago Press (www.scientificstyleandformat.org/).

Preparing the Manuscript File

Manuscripts should be typed double-spaced (in Microsoft Word) with lines and pages numbered consecutively, using Times New Roman font at 12 points. Special characters (e.g., Greek, math, symbols) should be inserted using the symbols palette available in this font. Complex math should be entered using MathType from Design Science (www.dessci.com). Note that equations created using the Equation Builder in Microsoft Word 2007 (and later versions) may not be compatible with earlier versions of Word or other software used in our composition system. Tables and figures should be placed in separate sections at the end of the manuscript (not placed within the text). Failure to follow these instructions may result in immediate rejection of the manuscript.

Interpretive Summary

All authors of JDS papers should provide an interpretive summary (IS) of 100 words or less that has been written for nonspecialist readers. The summary should consist of a title, the first author's last name, and a summary, which must include a sentence or two to summarize the project's expected importance, or its economic, environmental, and/or social impact. Common abbreviations are permitted (those from the JDS Unrestricted list). The summary should appear at the top of the first page of the manuscript, before the running head and title. Interpretive summaries will be peer reviewed. At publication, interpretive summaries will appear in a section at the beginning of the journal. The summaries are intended for an audience who may not be familiar with work in the authors' area of expertise and for government or media researchers, and they will provide JDS readers with a brief overview of the research presented in each issue.

Headings

Major Headings. Major headings are centered, in all capitals and boldface, and consist of ABSTRACT, INTRODUCTION, MATERIALS AND METHODS, RESULTS, DISCUSSION (or RESULTS AND DISCUSSION), CONCLUSIONS (optional), ACKNOWLEDGMENTS, APPENDIX (optional), and REFERENCES.

First Subheadings. First subheadings are placed on a separate line, begin at the left margin, the first letter of all important words is capitalized, and the headings are boldface and italic. The heading is not followed by punctuation. Text that follows a first subheading should be in a new paragraph.

Second Subheadings. Second subheadings begin the first line of a paragraph. They are indented, boldface, italic, and followed by a period. The first letter of each important word should be capitalized. The text follows immediately after the final period of the subheading.

Short Communications, Technical Notes, and Hot Topics do not use headings except for ACKNOWLEDGMENTS, REFERENCES, and APPENDIX.

Title Page

Across the top of the title page (first page), indicate a running head (abbreviated title) of no more than 45 characters. The running head is centered and uppercase. Dairy Industry Today and Hot Topic serve as the running heads for those respective article types. Short Communications, Technical Notes, Invited Reviews, and Letters to the Editor use a running head beginning with the appropriate designation (i.e., SHORT COMMUNICATION:) followed by a short title.

The title should be in boldface; the first letter of the article title (and subtitle, if present) and proper names are capitalized and the remainder of the title is lowercase. The title should contain words or phrases used for indexing the article.

Under the title, names of authors should be given in mixed case (e.g., T. E. Smith or Tom E. Smith) and in boldface. Institutional addresses are displayed below the author names; footnotes referring from author names to displayed addresses should be symbols **in the following order**: *, †, ‡, §, #, ||, and ¶. The full name, mailing address, phone number, and e-mail address of the corresponding author should appear directly below the affiliation lines on the title page. The corresponding author will be identified by a numbered footnote and e-mail address below the accepted line on the first page of the published article (e.g., ¹Corresponding author: my_name@university.edu). Supplementary address information may be given in footnotes to the first page; use numerals for these footnotes. Acronyms (except USDA) for affiliations are discouraged unless the acronym is the official name. The state or provincial postal code abbreviation is not included between the city and postal code if the state or province is previously mentioned in the address (see example). Acceptable format is shown below:

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Abstract. Abstracts should be limited to 2,500 keystrokes (i.e., characters plus spaces). The abstract should review important objectives, materials, results, conclusions, and applications as concisely as possible. The abstract disseminates scientific information through abstracting journals and is a convenience for readers. Open the abstract with objectives and make the abstract intelligible without reference to the manuscript. Use complete sentences and standard terms. Limit the use of abbreviations in the Abstract. Refer to the list on the inside front cover of JDS or Appendices 1 and 2 of this document for those terms that should be defined in the abstract. If a term is used fewer than 3 times in the abstract, it should be spelled out at each use.

Minimize the amount of data in the abstract and exclude statements of statistical probability (e.g., $P < 0.05$). Exclude references to other work because the abstracts will appear online and in indexing services without the accompanying reference list.

Key Words. After the abstract, list 2 to 5 key words or phrases; they should be typed in lowercase letters and separated by commas. Key words should be singular (e.g., “dairy cow” not “dairy cows”).

Abbreviations

Author-derived abbreviations should be defined at first use in the abstract and again in the body of the manuscript, and in each table and figure in which they are used. Author-derived abbreviations will be shown in bold type at first use in the body of the manuscript. Refer to the “Miscellaneous Usage Notes” on page 10 for more information on abbreviations.

Body of the Paper

The body of the paper should contain an introduction to the problem (questions, objectives, reasons for research, and related literature); materials, methods, experimental design, and procedures; and results, discussion, conclusions, and applications.

The introduction should concisely describe the rationale for conducting the study, background, objectives, and hypotheses to be tested. The introduction should be no longer than 4,000 characters (words and spaces).

Results and Discussion may be combined into a single section. If not, the Results section should not contain discussion of previously published work. Results and references to tables and figures already described in the results section should not be repeated in the Discussion section. The conclusions section (optional) should consist of one brief paragraph summarizing

only the main findings of the study. As such, it should not contain references to other works.

Appendix

A technical appendix may follow the References section. The appendix may contain supplementary material, explanations, and elaborations that are not essential to other major sections but are helpful to the reader. Novel computer programs or mathematical computations would be appropriate. The appendix will not be a repository for raw data.

References

List only pertinent references. No more than 3 references should be needed to support a specific concept. Research papers and reviews should cite a reasonable number of references. Abstracts and articles from non-peer-reviewed magazines and proceedings should be cited sparingly. Citation of abstracts published more than 3 yr ago is strongly discouraged.

Citations in 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 that the authors' names be included in parentheses, the proper format is (Smith and Jones, 1982; Jones, 1988a,b; Jones et al., 1993), with citations listed chronologically (i.e., oldest first) and then alphabetically within a year. Where there are more than 2 authors, the first author's name is followed by the abbreviation “et al.” in text (but all authors should be listed in the Reference section). Work that has not been accepted for publication should be listed in the text as follows: “J. E. Jones (institution, city, and state, personal communication).” The author's own unpublished work should be listed in the text as “(J. Smith, unpublished data).” Personal communications and unpublished data (including papers under review) must not be included in the references section.

References Section. To be listed in the references section, papers must be published or accepted for publication. Manuscripts submitted for publication but not yet accepted can be cited as “unpublished data” in the text. In the references section, references are listed alphabetically by author(s) last name(s), and then chronologically. The year of publication follows the authors' names. As with text citations, two or more publications by the same author or set of authors in the same year should be differentiated by adding lowercase letters after the date. The dates for papers with the same first author that would be abbreviated in the text as et al., even though the second and subsequent authors differ, shall also be differentiated by letters. All authors' names must appear in the reference section. Journals should

be abbreviated according to the conventional ISO abbreviations used by PubMed (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=journals>). One-word journal names (e.g., Theriogenology) are not abbreviated.

For journal articles, include all authors (do not use “et al.”), year, article title (lowercased except for first word and proper nouns), abbreviated journal name, volume, page range, and digital object identifier (DOI). Inclusive page numbers (or article identifiers) must be provided, and DOI should be given whenever possible, with the prefix “<http://dx.doi.org/>”.

For book references, include authors, year, chapter or section title, page range, book title, edition, book editors (if applicable), and publisher name and location.

For conference proceedings, include authors, year, abstract title, page number or abstract number, proceedings title, location of meeting, and name and location of proceedings publisher. For abstracts presented at ADSA or joint annual meetings, cite as a journal article but include the journal supplement number and the page of the supplement on which the abstract appeared. Include “(Abstr.)” at the end of the citation.

For patents, provide names of inventors, year, title, name of assignee, and US or other patent number.

For websites, provide authors (or organization name), year, page title, date accessed (in month, day, year format), and URL.

For theses, provide author, year, title, thesis type (PhD, MS, DVM), department name, and university name and location.

Sample references are given below.

Journals

- Buch, L. H., A. C. Sorensen, J. Lassen, P. Berg, J.-A. Eriksson, J. H. Jakobsen, and M. K. Sorensen. 2011. Hygiene-related and feed-related hoof diseases show different patterns of genetic correlations to clinical mastitis and female fertility. *J. Dairy Sci.* 94:1540–1551. <http://dx.doi.org/10.3168/jds.2010-3137>.
- Chapinal, N., A. M. de Passille, D. M. Weary, M. A. Hayes, B. J., P. J. Bowman, A. C. Chamberlain, K. Savin, C. P. van Tassell, T. S. Sonstegard, and M. E. Goddard. 2009. A validated genome-wide association study to breed cattle adapted to an environment altered by climate change. *PLoS ONE* 4:e6676.
- de Vries, M. J., and R. F. Veerkamp. 2000. Energy balance of dairy cattle in relation to milk production variables and fertility. *J. Dairy Sci.* 83:62–69.
- Jenkins, T. C., E. Block, and P. H. Morris. 2011. Potassium reduces the accumulation of *trans*-10, *cis*-12 conjugated linoleic acid and *trans*-18:1 in continuous cultures of mixed ruminal microorganisms regardless of dietary fat level. *J. Dairy Sci.* 94(E-Suppl. 1):509. (Abstr.)
- VanRaden, P. M. 2008. Efficient methods to compute genomic predictions. *J. Dairy Sci.* 91:4414–4423.

Books

- AOAC International. 2012. *Official Methods of Analysis*. 19th ed. AOAC International, Gaithersburg, MD.

- Goering, H. K., and P. J. Van Soest. 1970. *Forage Fiber Analyses (Apparatus, Reagents, Procedures, and Some Applications)*. Agric. Handbook No. 379. ARS-USDA, Washington, DC.
- Lengemann, F. W., R. A. Wentworth, and C. L. Comar. 1974. Physiological and biochemical aspects of the accumulation of contaminant radionuclides in milk. Pages 159–170 in *Lactation: A Comprehensive Treatise. Nutrition and Biochemistry of Milk/Maintenance*. Vol. 3. B. L. Larson and V. R. Smith, ed. Academic Press, London, UK.
- National Research Council. 2001. *Nutrient Requirements of Dairy Cattle*. 7th rev. ed. Natl. Acad. Press, Washington, DC.

Conferences

- Barbano, D. M. 1996. Mozzarella cheese yield: Factors to consider. Page 29 in *Proc. Wisconsin Cheese Makers Mtg.*, Madison. Ctr. Dairy Res., Univ. Wisconsin, Madison.
- National Mastitis Council. 1995. Summary of peer-reviewed publications on efficacy of pre-milking and post-milking teat disinfections published since 1980. Pages 82–92 in *Natl. Mastitis Council. Reg. Mtg. Proc.*, Harrisburg, PA. Natl. Mastitis Council, Inc., Madison, WI.

Other

- Biernoth, G., and W. Merk, inventors. 1985. Fractionation of milk fat using a liquified gas or a gas in the supercritical state. Unilever NV-PLC, assignee. US Pat. No. 4,504,503.
- FASS. 2010. *Guide for the Care and Use of Agricultural Animals in Research and Teaching*. 3rd ed. Federation of Animal Science Societies, Champaign, IL.
- Interbull. 2008. Genetic evaluation. Direct longevity. Accessed Dec. 20, 2012. <http://www-interbull.slu.se/longevity/1-aug08.html>.
- Kelly, M. G. 1977. Genetic parameters of growth in purebred and crossbred dairy cattle. MS Thesis. North Carolina State Univ., Raleigh.
- US Department of Agriculture, Plant and Animal Health Inspection Service. 2004. Blood and tissue collection at slaughtering and rendering establishments, final rule. 9CFR part 71. Fed. Regist. 69:10137–10151.

Tables

The use of tables should be minimized; however, tables may be the most effective way to organize data. When used, tables should be self-explanatory and understandable without excessive reference to the text. Table 1 in this document may be used as an example.

Tables must be prepared using the table feature in Microsoft Word; tables prepared in other programs (e.g., Excel) or by using spaces, tabs, and hard returns will not convert accurately and errors can result. When possible, tables should be organized to fit across the page without running landscape. Be aware of the dimensions of the printed page when planning tables (use of more than 15 columns may create layout problems).

Place the table number and title on the same line above the table (as shown in sample table). The table title should describe concisely the data shown; it does not require an ending period. Do not use vertical rules and use few horizontal rules. Bold and italic typefaces should not be used in tables, but when it is necessary to do so, such use must be defined in a footnote. Limit

Table 1. Effect of garlic oil, diallyl disulfide, allyl mercaptan, monensin, and lovastatin on a 17-h in vitro batch culture rumen microbial fermentation trial

Item	Treatment ¹						SEM
	Control	GAR300	DAD300	ALM300	MON	LOV	
pH	6.6	6.7	6.7	6.6	6.6	6.6	0.01
Apparent disappearance of DM, %	61.0 ^a	50.7 ^b	51.2 ^b	60.4 ^a	53.9 ^b	62.4 ^a	1.11
Fiber digestibility							
NDF, %	56.8 ^a	44.3 ^b	41.4 ^b	55.9 ^a	39.3 ^b	60.0 ^a	1.73
ADF, %	53.7 ^a	36.8 ^b	34.9 ^b	52.5 ^a	30.7 ^b	57.0 ^a	2.03
Gas, μmol	4,674.8 ^a	3,756.9 ^{cd}	3,359.7 ^d	4,388.2 ^{ab}	4,009.6 ^{bc}	4,673.1 ^a	123.34
CH ₄ , μmol	417.3 ^a	110.1 ^d	131.3 ^d	335.9 ^b	241.7 ^c	396.3 ^a	21.56
Total VFA, mM	49.3 ^a	39.7 ^c	38.8 ^c	45.4 ^b	45.7 ^{ab}	48.4 ^{ab}	1.17
Individual, mol/100 mol							
Acetate	61.2 ^a	54.3 ^d	53.9 ^d	58.3 ^b	56.4 ^c	61.1 ^a	0.53
Propionate	22.6 ^d	25.8 ^c	28.3 ^b	22.8 ^d	34.2 ^a	22.8 ^d	0.78
Butyrate	12.5 ^c	16.5 ^a	14.0 ^{bc}	15.0 ^{ab}	6.6 ^d	12.4 ^c	0.60
Branched-chain VFA	2.0 ^a	1.7 ^b	1.7 ^b	2.0 ^a	1.4 ^c	2.0 ^a	0.10
C2:C3	2.7 ^a	2.1 ^b	1.9 ^c	2.5 ^a	1.6 ^d	2.7 ^a	0.07
CH ₄ (μmol):VFA (μmol)	0.20 ^a	0.05 ^d	0.07 ^{cd}	0.15 ^{ab}	0.10 ^{bcd}	0.17 ^{ab}	0.00
N-NH ₃ , mg/100 mL	16.7 ^{ab}	16.6 ^{bc}	19.0 ^a	17.2 ^{ab}	14.4 ^c	16.4 ^{bc}	1.10

^{a-d}Means within a row with different superscripts differ ($P < 0.05$).

¹Treatments: GAR300 = 300 mg/L *Allium sativa* (garlic oil); DAD300 = 300 mg/L diallyl disulfide; ALM300 = 300 mg/L allyl mercaptan; MON = 12.5 mg/L monensin; LOV = 5 mg/L lovastatin.

the data field to the minimum needed for meaningful comparison within the accuracy of the methods.

For each table, define author-derived abbreviations in parentheses or in numbered footnotes. Abbreviations should conform to journal style and be consistent with those used in the text.

For differences among means within a row or column, superscript letters should be used as appropriate sequentially (e.g., a, ab, b, c, cd) consistently from largest to smallest means and defined in the footnote. Informational footnotes should be numbered and each footnote should begin a new line (see sample table). Probability may be indicated in a separate footnote following any informational footnotes thus: † $P < 0.10$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Figures

To facilitate review, figures should be placed at the end of the manuscript (separated by section breaks). Each figure should be placed on a separate page, and identified by the last name of the first author and figure number. Figure captions should be typed (double spaced) on a separate page.

• **Figure size.** Prepare figures at final size for publication. Figures should be prepared to fit one column (8.9 cm wide), 2 columns (14 cm wide), or full-page width (19 cm wide).

• **Font size.** Ensure that all type within the figure and axis labels is readable at final publication size. A minimum type size of 8 points (after reduction to pub-

lication size) should be used. The font size should be proportional to the overall size of the figure (within a range of 8 to 12 points at final publication size).

• **Fonts.** For best readability, use Helvetica, Times New Roman, Arial, and the symbols palette within those fonts only.

• **Line weight.** For line graphs, use a minimum stroke weight of 1 point for all lines. If multiple lines are to be distinguished, use solid, long-dash, short-dash, and dotted lines. Avoid the use of gray lines, as these will not reproduce well. Lines with different symbols for the data points may also be used to distinguish curves.

• **Axis labels.** Each axis should have a descriptor and a unit. Units may be separated from the descriptor by a comma or parentheses.

• **Shading and fill patterns.** For bar charts, use different fill patterns if needed (e.g., black, white, gray, diagonal stripes). Avoid the use of multiple shades of gray, as they will not be easily distinguishable in print. Complex patterns and 3-dimensional effects reproduce poorly. Remove unnecessary backgrounds and grid-lines from graphs.

• **Symbols.** Identify curves and data points using the following symbols only: □, ■, ○, ●, ▲, ▼, △, ▽, ★, ☆, ◇, ◆, +, or ×. Symbols should be defined in the figure caption or in a key on the figure (but not both).

• **File formats.** Figures can be submitted in Word, PDF, EPS, TIFF, and JPEG formats.

• **Grayscale figures.** If figures are to be reproduced in grayscale (black and white), submit in grayscale. Often color will mask contrast problems that

are apparent only when the figure is reproduced in grayscale.

- **Color figures.** If figures are to appear in color in the print journal, files must be submitted in CMYK color (not RGB).

- **Resolution.** Minimum resolution is 600 dpi for grayscale and color figures, and 1,200 dpi for line art. Submitting figures that do not meet these requirements may delay publication of your article.

- **Photomicrographs.** Photomicrographs must have their unmagnified size designated with a scale bar on the figure. Reduction for publication can make a magnification power designation (e.g., 100×) inappropriate.

- **Captions.** The caption should provide sufficient information that the figure can be understood without excessive reference to the text. All author-derived abbreviations and symbols used in the figure should be defined in the caption.

- **General tips.** Do not use three-dimensional bar charts unless essential to the presentation of the data. Use the simplest shading scheme possible to present the data clearly. Ensure that data, symbols, axis labels, lines, and key are clear and easily readable at final publication size.

Color Charge. The cost to publish each color figure in the print journal is \$650; a surcharge for offprints will also be assessed. At the time of submission on Manuscript Central, authors will be asked to approve color charges for figures that they wish to have published in color in the print journal. Color versions of figures can be included in the online PDF and full-text article at no charge. Note that online color figures will be available in the final published version of the article (not in the galley proof for Articles in Press version).

Statistical Analysis

Biology should be emphasized, but the use of incorrect or inadequate statistical methods to analyze and interpret biological data is not acceptable. Consultation with a statistician is recommended. 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. A statement of the results of statistical analysis should justify the interpretations and conclusions. When possible, results of similar ex-

periments should be pooled statistically. Do not report a number of similar experiments separately.

Experimental Unit. The experimental unit is the smallest unit to which an individual treatment is imposed. For group-fed animals, the group of animals in the pen or the paddock is the experimental unit; therefore, groups must be replicated. Repeated chemical analyses of the same sample usually do not constitute independent experimental units. Measurements on the same experimental unit over time also are not independent and must not be considered as independent experimental units. For analysis of time effects, use time-sequence analysis.

Usual assumptions are that errors in the statistical models are normally and independently distributed with constant variance. Most standard methods are robust to deviations from these assumptions, but occasionally data transformations or other techniques are helpful. Most statistical procedures are based on the assumption that experimental units have been assigned to treatments at random. If animals are stratified by ancestry or weight or if some other initial measurement should be accounted for, the model should include a blocking factor, or the initial measurement should be included as a covariate.

A parameter [mean (μ), variance (σ^2)], which defines or describes a population, is estimated by a statistic (\bar{x} , s^2). The term *parameter* is not appropriate to describe a variable, observation, trait, characteristic, or measurement taken in an experiment.

Experimental Design. Standard designs are adequately described by name and size (e.g., “a randomized complete block design with 6 treatments in 5 blocks”). For a factorial set of treatments, an adequate description might be as follows: “Tryptophan at 0.05 or 0.10% of the diet and niacin at 5, 10, or 20 mg/kg of diet were used in a 2 × 3 factorial arrangement in 5 randomized complete blocks, each block consisting of littermates.” Note that a factorial arrangement is not a design; the term “design” refers to the method of grouping experimental units into homogeneous groups or blocks (i.e., the way in which the randomization is restricted).

Variability. Standard deviation refers to the variability in a sample or a population. The standard error (calculated from error variance) is the estimated sampling error of a statistic such as the sample mean. When a standard deviation or standard error is given, the number of degrees of freedom on which it rests should be specified. When any statistical value (as mean or difference of 2 means) is mentioned, its standard error or confidence limit should be given. The fact that differences are not “statistically significant” is no reason for omitting standard errors. They are of value

when results from several experiments are combined in the future. They are also useful to the reader as measures of efficiency of experimental techniques. **A value attached by “±” to a number implies that the second value is its standard error (not its standard deviation) unless otherwise specified.** Adequate reporting may require only (1) the number of observations, (2) arithmetic treatment means, and (3) an estimate of experimental error. The pooled standard error of the mean is the preferred estimate of experimental error. Standard errors need not be presented separately for each mean unless the means are based on different numbers of observations or the heterogeneity of the error variance is to be emphasized. Presenting individual standard errors clutters the presentation and can mislead readers.

For more complex experiments, tables of subclass means and tables of analyses of variance or covariance may be included. When the analysis of variance contains several error terms, such as in split-plot and repeated-measures designs, the text should indicate clearly which mean square was used for the denominator of each *F* statistic. Unbalanced factorial data can present special problems. Accordingly, it is appropriate to state how the computing was done and how the parameters were estimated. Approximations should be accompanied by cautions concerning possible biases.

Contrasts (preferably orthogonal) are used to answer specific questions for which the experiment was designed; they should form the basis for comparing treatment means. Nonorthogonal contrasts may be evaluated by Bonferroni *t* statistics. The exact contrasts tested should be described for the reader. Multiple-range tests are not appropriate when treatments are orthogonally arranged. Fixed-range, pairwise, multiple comparison tests should be used only to compare means of treatments that are unstructured or not related. In factorial treatment arrangements, means for main effects should be presented when important interactions are not present. Means for individual treatment combinations also should be provided in table or text so that future researchers may combine data from several experiments to detect important interactions. An interaction may not be detected in a given experiment because of a limitation in the number of observations.

Significance. The terms *significant* and *highly significant* traditionally have been reserved for $P < 0.05$ and $P < 0.01$, respectively; however, reporting the *P*-value is preferred to the use of these terms. For example, use “... we observed a difference ($P < 0.05$) between control and treated samples” rather than “...we observed a significant ($P < 0.05$) difference between control and treated samples.” When available, the observed significance level (e.g., $P = 0.03$) should be presented rather

than merely $P < 0.05$ or $P < 0.01$, thereby allowing the reader to decide what to reject. Other probability (alpha) levels may be discussed if properly qualified so that the reader is not misled. Do not report *P*-values to more than 2 or 3 places after the decimal (2 significant digits are usually sufficient). Regardless of the probability level used, failure to reject a hypothesis should be based on the relative consequences of Type I and II errors. A “nonsignificant” relationship should not be interpreted to suggest the absence of a relationship. An inadequate number of experimental units or insufficient control of variation limits the power to detect relationships. Avoid the ambiguous use of $P > 0.05$ to declare nonsignificance, such as indicating that a difference is not significant at $P > 0.05$ and subsequently declaring another difference significant (or a tendency) at $P < 0.09$. In addition, readers may incorrectly interpret the use of $P > 0.05$ as the probability of a beta error, not an alpha error.

Present only meaningful digits. A practical rule is to round values so that the change caused by rounding is less than one-tenth of the standard error. Such rounding increases the variance of the reported value by less than 1%, so that less than 1% of the relevant information contained in the data is sacrificed. In most cases, 2 or 3 significant digits (not decimal places) are sufficient.

Nomenclature: Genes and Proteins

The journal recommends using internationally accepted symbols for genes and proteins; such symbols may be used without definition. Symbols for specific genes and proteins can be obtained by querying the gene database of PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>). Nomenclature rules for humans, nonhuman primates, and livestock are available at <http://www.genenames.org>, and rules for mice and rats are at <http://www.informatics.jax.org/mgihome/nomen/strains.shtml>. Gene symbols should be shown in italics (e.g., *SERPINA14*) and proteins in roman text (e.g., SERPINA14). Gene symbols are generally shown in all uppercase letters (e.g., *LHB*), except in mice and rats, where only the first letter is capitalized (e.g., *Lhb*).

Nomenclature: Single Nucleotide Polymorphisms

The increasing number of SNP association studies and the improvements in bovine genome annotation require a standardized SNP nomenclature for unequivocal and correct SNP identification. Additionally, information regarding the SNP investigated should be easily accessible in a publicly available database. Therefore, all relevant SNP included in a study should be listed with their unique RefSNP (rs) or submitted

SNP (ss) number (if rs number is not yet available) as indicated in the public domain NCBI dbSNP database (<http://www.ncbi.nlm.nih.gov/snp>). If the SNP investigated do not yet have an entry in the NCBI dbSNP database, the authors of the manuscript are responsible for submitting all the required information to NCBI (see <http://www.ncbi.nlm.nih.gov/projects/SNP/>) for depositing the SNP into the database and obtaining a unique ss number for the SNP. In the text of the manuscript, use the rs/ss number of the SNP or an alternative standardized nomenclature.

Nomenclature: Microorganisms.

All microorganisms must be named by genus and species. The name of the genus must appear in full the first time that the microorganism is cited in the abstract, in the body of the paper, and in each table and figure legend. Thereafter, the genus can be abbreviated by its first initial unless it will be confused with other microorganisms cited in the paper, in which case each genus should be abbreviated to use enough letters to avoid confusion (e.g., *Strep.* vs. *Staph.*). The formal, binomial names of all microorganisms should be in italics. Specific strain designations and numbers should be used when appropriate.

For microorganisms that are genetic variants of a parent strain, the genotypic and phenotypic properties should be cited according to the procedures described by Demerec et al. (1966) in *Genetics* 54:61–76. Phenotypes should be identified by 3 letters; the first is capitalized. Genotypes should be identified by 3 lowercase italic letters. Superscript plus (+) signs are used to refer to a wild-type. The serial isolation number is placed after the locus symbol for mutations. The delta symbol is used to indicate deletions. Nomenclature for bacterial plasmids should be cited according to Novick et al. (1976) in *Bacteriological Reviews* 40:168–189.

Nomenclature: Enzymes

First mention of an enzyme within a manuscript should include the Enzyme Commission (EC) number (<http://www.chem.qmul.ac.uk/iubmb/enzyme/>).

In Vitro Antimicrobial Susceptibility Tests

Authors should avoid the use of the term “antibiotic” when referring to a specific agent unless that agent is naturally occurring and unmodified (e.g., penicillin). The broader term “antimicrobial agent” is preferred because it includes naturally produced agents, semi-synthetic agents, and totally synthetic agents. The

term “susceptibility” should be used instead of “sensitivity.” Authors unfamiliar with antimicrobial susceptibility testing should obtain CLSI (formerly NCCLS) document M31 (Clinical Laboratory Standards Institute, 940 W. Valley Rd., Suite 1400, Wayne, PA 19087-1898) for specific information regarding antimicrobial susceptibility testing of veterinary pathogens. CLSI or NCCLS equivalent methods for antimicrobial susceptibility testing available outside the US are also acceptable.

Two methods are generally used to generate antimicrobial susceptibility data: the agar disk diffusion (ADD) method and the minimum inhibitory concentration (MIC) method. The use of the term “Kirby-Bauer” to refer to the ADD method is incorrect and should be avoided. The correct citation for this method is the “disk diffusion method of Bauer et al.” The ADD method is a qualitative method and results should be reported as susceptible, intermediate, or resistant (SIR). If zone of inhibition diameters are reported, these should be reported in millimeters.

The MIC method is quantitative and results should be reported in micrograms per milliliter ($\mu\text{g/mL}$). The minimum summary statistics for reporting MIC results from multiple strains of an organism are the MIC₅₀, the MIC₉₀, and the range. The MIC₅₀ and MIC₉₀ represent the concentrations required to inhibit 50 and 90% of the strains, respectively. The MIC₅₀ and MIC₉₀ reported should be the actual concentrations tested, not values calculated from the actual data obtained. When <10 isolates of a species are tested, tabulate only the MIC range of each antimicrobial agent tested. If more than a single drug is studied, insert a column labeled “test agent” between the columns listing the organisms and the columns containing the numerical data, and record data for each agent in the same isolate order. In addition, the percentage of strains categorized as susceptible, intermediate, or resistant may be reported. If only one of these categories is to be reported, the percent susceptible value is preferred. If the percentage of resistant isolates is to be reported for an agent, it should include isolates categorized as intermediate.

The percentage of strains susceptible or resistant to an antibiotic at its breakpoint concentration may be given only if an appropriate breakpoint has been approved, as by CLSI. Given the paucity of approved breakpoints for mastitis pathogens, authors may use breakpoints from other species (e.g., human breakpoints for ampicillin or canine breakpoints for enrofloxacin). However, authors must clearly state that the breakpoints are not approved for mastitis pathogens. Moreover, authors cannot assign breakpoints or use breakpoints from related antibiotics (except for class

testing purposes) or breakpoints developed for other methods.

Authors must indicate that the appropriate quality control tests were performed. Information regarding the frequency of testing and the specific strains tested should be provided. The frequency of quality control testing and organisms tested should conform to the recommendations in the CLSI standard (document M31) or equivalent. A single statement in the manuscript indicating that the results obtained for the quality control documents were within published ranges is acceptable. However, authors may be requested to provide the quality control information during the manuscript review cycle.

Sensory Data

Sensory data should comply with “Invited Review: Sensory Analysis of Dairy Foods,” *Journal of Dairy Science* 90:4925–4937. <http://dx.doi.org/10.3168/jds.2007-0332>.

Miscellaneous Usage Notes

Abbreviations. Abbreviations should not be used in the title, key words, or to begin sentences, except when they are widely known throughout science (e.g., DNA, RNA) or are terms better known by their abbreviation (e.g., IgG, CD). Abbreviations may be used in heads within the paper if they have been first defined within the text. The inside front cover of every issue of the journal lists abbreviations that can be used without definition (see also Appendices 1 and 2). Abbreviations are allowed when they help the flow of the manuscript; however, excessive use of abbreviations can confuse the reader. The suitability of abbreviations will be evaluated by the reviewers and editors during the review process and by the technical editor during editing. Generally, author-derived abbreviations should be in all capital letters. Terms used fewer than 3 times after first use must be spelled out in full rather than abbreviated. Do not use capitalized whole words (e.g., CORN) as treatment abbreviations, or single-letter abbreviations that could be confused with chemical elements (e.g., P, C, S). All terms are to be spelled out in full with the abbreviation following in bold type in parentheses the first time they are mentioned in the main body of the text. Abbreviations shall be used consistently thereafter.

The abstract, text, each table, and each figure must be understood independently of each other. Therefore, abbreviations shall be defined within each of these units of the manuscript.

Plural forms of abbreviations do not require “s.” Chemical symbols and 1-letter and 3-letter abbrevia-

tions for amino acids do not need definition. Bacterial genus names are abbreviated according to the guidelines recommended in *Scientific Style and Format* (8th ed.). Units of measure, except those in the standard JDS abbreviation list, should be abbreviated according to standard SI usage and do not need to be defined. See “Appendix 2” on page 13 for a list of commonly used terms.

Foreign and Latin Words and Phrases. Non-English words in common usage (i.e., given in recent editions of standard dictionaries) will not appear in italics (e.g., *in vitro*, *in vivo*, *ad libitum*, *in situ*, *a priori*). However, genus and species of plants, animals, or bacteria and viruses should be italicized. Authors must indicate accent marks and other diacriticals on international names and institutions. German nouns shall begin with capital letters.

Capitalization. Breed and variety names are to be capitalized (e.g., Holstein, Danish Red). Trademarked or registered names should be capitalized, but no TM or [®] symbols should be used. Proper nouns should be capitalized.

Numbers and Units. The *Journal of Dairy Science* uses the Council of Science Editors’ number style given in the eighth edition of *Scientific Style and Format*.

Numbers less than 1 shall be written with preceding zeros (e.g., 0.75). All numbers shall be written as digits; a comma separator must be used in numbers greater than 999 (e.g., 2,478). Measures must be in the metric (SI) system; however, US equivalents may be given in parentheses. Units of measure not associated with a numeric value should be written out rather than abbreviated (e.g., lysine content was measured in milligrams per kilogram of diet) unless used parenthetically. Measures of variation must be defined in the Abstract and in the body of the paper at first use.

General Usage. Note that “and/or” is not permitted; choose the more appropriate meaning or use “x or y or both.”

Use the slant line only when it means “per” with numbered units of measure or “divided by” in equations. Use only one slant line in a given expression: e.g., g/cow per day. The slant line may not be used to indicate ratios or mixtures.

Insert spaces around all signs (except slant lines) of operation (=, −, +, ×, >, or <) when these signs occur between 2 items.

Items in a series should be separated by commas: a, b, and c.

Commercial Products. The use of names of commercial products should be minimized. When a commercial product is being tested as part of the experiment, the manufacturer and location should be given

parenthetically at first mention in text, tables, and figures, but, when possible, the generic name should be used thereafter. Only generic names should be used in article titles. Trademark symbols and registration marks should not be used and will be removed.

Studies using commercial products should address a hypothesis-based question relevant to the biology or mechanism of action of the product. Avoid describing a method as “per manufacturer’s instructions.” If the product goes out of production, the method will be lost to readers. Many products come with literature references; try to use references that can be found by other researchers to describe a method being used.

Supplemental Information

The following information is available online and updated regularly. Please refer to these pages when preparing a manuscript for submission.

SI Units. The following site (National Institute of Standards and Technology) provides a comprehensive guide to SI units and usage: <http://physics.nist.gov/cuu/Units/index.html>.

Figure and Table Preparation Guidelines. Current information on figure and table preparation can be found at <http://www.journalofdairyscience.org/>.

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Appendix 1 ABBREVIATIONS

Revised December 2015

The following abbreviations may be used without definition in the *Journal of Dairy Science*. In addition, abbreviations of all chemical elements, common combinations of chemical elements, SI units of measure used with a value, and common amino acids (3-letter and 1-letter abbreviations) should be used without definition. Abbreviations are generally not permitted in the title, running head, and key words. Plural abbreviations do not require "s".

Unrestricted Use

AA = amino acid
ACTH = adrenocorticotropin
AMP, ADP, ATP = adenosine mono-, di-, or triphosphate
ANOVA = analysis of variance
ATPase = adenosine triphosphatase
BLUP = best linear unbiased predictor
BSA = bovine serum albumin
cDNA = complementary deoxyribonucleic acid
DEAE = diethyl amino ethyl
DNA = deoxyribonucleic acid
DNase = deoxyribonuclease
EDTA = ethylenediaminetetraacetate
EGTA = ethylene glycol tetraacetate
ELISA = enzyme-linked immunosorbent assay
FSH = follicle-stimulating hormone
GAPDH = glyceraldehyde 3-phosphate dehydrogenase
GnRH = gonadotropin-releasing hormone
HEPES = *N*-2-hydroxyethyl piperazine-*N'*-ethanesulfonic acid
HPLC = high performance (pressure) liquid chromatography
IFN = interferon
Ig = immunoglobulin
IL = interleukin
LH = luteinizing hormone
mAb = monoclonal antibody
mRNA = messenger ribonucleic acid
NAD⁺/NADH = nicotinamide adenine dinucleotide (oxidized/reduced)
NADP = nicotinamide adenine dinucleotide phosphate
NADPH₂ = reduced nicotinamide adenine dinucleotide phosphate
PAGE = polyacrylamide gel electrophoresis
PCR = polymerase chain reaction
PGF_{2α} = prostaglandin F_{2α}
REML = restricted maximum likelihood
RFLP = restriction fragment length polymorphism
RIA = radioimmunoassay
RNA = ribonucleic acid
RNase = ribonuclease
rRNA = ribosomal ribonucleic acid
Tris = tris(hydroxymethyl)aminomethane
UHT = ultra-high temperature
USDA = United States Department of Agriculture
UV = ultraviolet

Define in Abstract; Unrestricted Use Elsewhere

ADF = acid detergent fiber
ADG = average daily gain
ADL = acid detergent lignin
ADIN = acid detergent insoluble nitrogen
AI = artificial insemination
BCS = body condition score
BHB = β-hydroxybutyrate
bST = bovine somatotropin
BTA = *Bos taurus* autosome
BUN = blood urea nitrogen
BW = body weight
CI = confidence interval*
CLA = conjugated linoleic acid
CN = casein
CNS = coagulase-negative staphylococci
CoA = coenzyme A
CP = crude protein
CV = coefficient(s) of variation*
DCAD = dietary cation-anion difference
df = degrees of freedom*
DHI(A) = Dairy Herd Improvement (Association)
DIM = days in milk
DM = dry matter

DMI = dry matter intake
EAA = essential amino acid
EBV = estimated breeding value
ECM = energy-corrected milk
ETA = estimated transmitting ability
FAME = fatty acid methyl esters
FCM = fat-corrected milk
GC = gas chromatography
GLC = gas-liquid chromatography
h² = heritability*
HTST = high temperature, short time
IGF = insulin-like growth factor
IMI = intramammary infection
α-LA = α-lactalbumin
β-LG = β-lactoglobulin
LPS = lipopolysaccharide
LSD = least significant difference*
LSM = least squares means*
ME = metabolizable energy
MIC = minimum inhibitory concentration
MP = metabolizable protein
MS = mass spectrometry
MUFA = monounsaturated fatty acids
MUN = milk urea nitrogen
n = number of samples*
NAN = nonammonia nitrogen
NDF = neutral detergent fiber
NDIN = neutral detergent insoluble N
NDM = nonfat dry milk
NEAA = nonessential amino acid
NE_G = net energy for gain
NE_L = net energy for lactation
NE_M = net energy for maintenance
NFC = nonfiber carbohydrates
NPN = nonprotein nitrogen
NRC = National Research Council
NS = nonsignificant*
NSC = nonstructural carbohydrates
OM = organic matter
PBS = phosphate-buffered saline
PMN = polymorphonuclear leukocyte
PTA = predicted transmitting ability
PUFA = polyunsaturated fatty acids
r = correlation coefficient*
R² = coefficient of determination*
QTL = quantitative trait loci
RDP = rumen-degradable protein
RUP = rumen-undegradable protein
SARA = subacute ruminal acidosis
SCC = somatic cell count
SCS = somatic cell score
SD = standard deviation*
SDS = sodium dodecyl sulfate
SE = standard error*
SEM = standard error of the mean*
SFA = saturated fatty acids
SNF = solids-not-fat
SNP = single nucleotide polymorphism
SPC = standard plate count
TDN = total digestible nutrients
TMR = total mixed ration
TS = total solids
UF = ultrafiltration, ultrafiltered
UFA = unsaturated fatty acids
VFA = volatile fatty acids

*Use generally restricted to tables and parenthetical expressions; spell out at first use in running text.

Appendix 2
Selected Units and Terms

The following units and terms can be used without definition in the *Journal of Dairy Science*.

atomic mass unit	amu	millimole (mass)	mmol
atmosphere	atm	minute(s)	min
base pair	bp	molar (concentration)	<i>M</i>
calorie (gram)	cal	molar (mass)	mol
celsius (with number)	°C	mole (number, mass)	mol
centimeter	cm	month(s)	mo
centimeter, square	cm ²	morning/afternoon	a.m./p.m.
circa	ca.	nano	n (prefix)
centimorgan	cM	newton	N
centipoise	cP	normal (concentration)	<i>N</i>
central processing unit	CPU	nanogram	ng
colony-forming unit	cfu	osmolality	use mmol/kg
counts per minute	cpm	outside diameter	o.d.
counts per second	cps	parts per billion	ppb (use µg/kg or equivalent)
crossed with, times	×	parts per million	ppm (use mg/kg or equivalent)
cubic	cu	pascal	Pa
cubic centimeter	cc, cm ³	pico	p (prefix)
cubic millimeter	mm ³	picogram	pg
curie	Ci	plaque-forming unit	pfu
cycles per second (hertz)	Hz	probability	<i>P</i>
day(s)	d	revolutions per minute	rpm
dalton	Da	second(s)	s
deci	d (prefix)	siemens	S
deciliter	dL	species	spp.
electron volt	eV	subcutaneous	s.c.
equivalents	Eq	subspecies	ssp.
foot-candle	use lx	unit	U
gram	g	volt	V
gravity	<i>g</i>	volume	vol
hectare	ha	volume/volume	vol/vol (use parenthetically)
hour(s)	h	watt	W
inside diameter	i.d.	week(s)	wk
international unit	IU	weight/volume	wt/vol (use parenthetically)
intramuscularly	i.m.	year(s)	yr
intraperitoneally	i.p.		
intravenously	i.v.	Amino Acids	
joule	J	alanine	Ala
kilo	k (prefix)	arginine	Arg
kilobase	kb	asparagine	Asn
kilobyte	KB	aspartic acid	Asp
kilocalorie	kcal	citrulline	Cit
kilogram	kg	cysteine	Cys
kilopascal	kPa	glutamic acid	Glu
liter	L	glutamine	Gln
logarithm (natural)	ln	glycine	Gly
logarithm (base 10)	log ₁₀	histidine	His
lux	lx	isoleucine	Ile
mega	M (prefix)	leucine	Leu
meter	m	lysine	Lys
metric tonne	tonne or t	methionine	Met
micro	µ (prefix)	ornithine	Orn
microcurie	µCi	phenylalanine	Phe
microfarads	µF	proline	Pro
microgram	µg	serine	Ser
microliter	µL	threonine	Thr
milli	m (prefix)	tryptophan	Trp
milliliter	mL	tyrosine	Tyr
millimeters of mercury	mm Hg	valine	Val
millimolar (concentration)	mM (= mmol/L)		