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Correspondent footnote. The complete mailing address, a single telephone number, a single fax number, and a single e-mail address for the corresponding author should be included on the title page of the manuscript. This information will be published in the article as a footnote to facilitate communication, and the e-mail address will be used to notify the corresponding author of availability of proofs and, later, of the PDF file of the published article.

Abstract. Limit the abstract to 250 words or fewer and concisely summarize the basic content of the paper without presenting extensive experimental details. Avoid abbreviations and references, and do not include diagrams. When it is essential to include a reference, use the same format as shown for the References section but omit the article title. Because the abstract will be published separately by abstracting services, it must be complete and understandable without reference to the text.

Introduction. The introduction should supply sufficient background information to allow the reader to understand and evaluate the results of the present study without referring to previous publications on the topic. The introduction should also provide the hypothesis that was addressed or the rationale for the present study. Use only those references required to provide the most salient background rather than an exhaustive review of the topic.

Materials and Methods. The Materials and Methods section should include sufficient technical information to allow the experiments to be repeated. When centrifugation conditions are critical, give enough information to enable another investigator to repeat the procedure: make of centrifuge, model of rotor, temperature, time at maximum speed, and centrifugal force ($\times g$ rather than revolutions per minute). For commonly used materials and methods (e.g., media and protein concentration determinations), a simple reference is sufficient. If several alternative methods are commonly used, it is helpful to identify the method briefly as well as to cite the reference. For example, it is preferable to state “cells were broken by ultrasonic treatment as previously described..."
(9)” rather than to state “cells were broken as previously described (9).” The reader should be allowed to assess the method without constant reference to previous publications. Describe new methods completely and give sources of unusual chemicals, equipment, or microbial strains. When large numbers of microbial strains or mutants are used in a study, include tables identifying the immediate sources (i.e., sources from whom the strains were obtained) and properties of the strains, mutants, bacteriophages, plasmids, etc.

Enzyme purifications should be described in this section, but the results of such procedures should be described in the Results section. A method, strain, etc., used in only one of several experiments reported in the paper may be described in the Results section or very briefly (one or two sentences) in a table footnote or figure legend. It is expected that the sources from whom the strains were obtained will be identified.

Results. The Results section should include the results of the experiments. Reserve extensive interpretation of the results for the Discussion section. Present the results as concisely as possible in one of the following: text, table(s), or figure(s). Avoid extensive use of graphs to present data that might be more concisely presented in the text or tables. For example, except in unusual cases, double-reciprocal plots used to determine apparent $K_m$ values should not be presented as graphs; instead, the values should be stated in the text. Similarly, graphs illustrating other methods commonly used (e.g., calibration plots for molecular weight by gel filtration or electrophoresis) need not be shown except in unusual circumstances. Limit photographs (particularly photomicrographs and electron micrographs) to those that are absolutely necessary to show the experimental findings. Number figures and tables in the order in which they are cited in the text, and be sure to cite all figures and tables.

Discussion. The Discussion should provide an interpretation of the results in relation to previously published work and to the experimental system at hand and should not contain extensive repetition of the Results section or reiteration of the introduction. In short papers, the Results and Discussion sections may be combined.

Acknowledgments. The source of any financial support received for the work being published must be indicated in the Acknowledgments section. (It will be assumed that the absence of such an acknowledgment is a statement by the authors that no support was received.) The usual format is as follows: “This work was supported by Public Health Service grant CA-01234 from the National Cancer Institute.” Recognition of personal assistance should be given as a separate paragraph, as should any statements disclaiming endorsement or approval of the views reflected in the paper or of a product mentioned therein.

References. (i) Works listed in References. The References section must include all journal articles (both print and online), books and book chapters (both print and online), patents, theses and dissertations, and published conference proceedings (not abstracts; see below), as well as in-press journal articles, book chapters, and books (publication title must be given). All listed references must be cited in the text. Arrange the citations in alphabetical order (letter by letter, ignoring spaces and punctuation) by first author and number consecutively. Provide the names of all the authors for each reference. Since title and byline information that is downloaded from PubMed does not show accents, italics, or special characters, authors should refer to the PDF files or hard-copy versions of the articles and incorporate the necessary corrections in the submitted manuscript. Abbreviate journal names according to BIOSIS Serial Sources (BIOSIS, Philadelphia, Pa., 2003). Cite each listed reference by number in the text. Follow the styles shown in the examples below.

Print references:


*A reference to an in-press ASM publication should state the control number (e.g., JB00577-04) if it is a journal article or the name of the publication if it is a book.

\textbf{Online references:}


\textbf{Notes}

The Note format is intended for the presentation of brief observations that do not warrant full-length papers. Submit Notes in the same way as full-length papers. They receive the same review, they are not published more rapidly than full-length papers, and they are not considered preliminary communications.

Each Note must have an \textbf{abstract of no more than 50 words}. Do not use section headings in the body of the Note; combine methods, results, and discussion in a single section. Paragraph lead-ins are permissible. The text should be kept to a minimum and if possible should not exceed 1,000 words; the number of figures and tables should also be kept to a minimum. Materials and methods should be described in the text, not in the figure legends or table footnotes. Present acknowledgments as in full-length papers, but do not use a heading. The References section is identical to that of full-length papers.

\textbf{Minireviews}

Minireviews are brief \textit{(limit of 6 printed pages exclusive of references)} biographical profiles, historical perspectives, or summaries of developments in fast-moving areas. They must be based on published articles; they may address any subject within the scope of the journal. Minireviews may be either solicited or proffered by authors responding to a recognized need. Irrespective of origin, Minireviews are subject to review and should be
submitted via Rapid Review. The cover letter should state whether the article was solicited and by whom.

Minireviews do not have abstracts. In the Abstract section of the submission form, put “Not applicable.” The body of the Minireview may either have section headings or be set up like a Note (see above).

Guest Commentaries

Guest Commentaries are communications written in response to invitations issued by the editors and concern relevant topics in bacteriology that are not necessarily covered by Minireviews. They should raise issues of interest to the scholarly community, initiate or focus discussion, and propose needed position or consensus statements by the Academy of Microbiology, the National Academy of Sciences, and other leadership groups in research and education. Reviews of the literature, methods and other how-to papers, and responses targeted at a specific published paper are not appropriate. Guest Commentaries are subject to review.

The length may not exceed 4 printed pages, and the format is like that of a Minireview (see above). Commentaries should be submitted via Rapid Review.

Errata

The Erratum section provides a means of correcting errors that occurred during the writing, typing, editing, or printing (e.g., a misspelling, a dropped word or line, or mislabeling in a figure) of a published article. Send Errata directly to the ASM Journals Department (1752 N St., N.W., Washington, DC 20036-2904, USA), both on disk and in hard copy (only one hard copy is necessary). Please see a recent issue for correct formatting.

Authors’ Corrections

The Author’s Correction section provides a means of correcting errors of omission (e.g., author names or citations) and errors of a scientific nature that do not alter the overall basic results of conclusions of a published article.

For omission of an author’s name, the authors of the article and the author whose name was inadvertently omitted must agree, in writing, to publication of the correction. Copies of the agreement letters must accompany the correction and be sent directly to the Journals Department. Send the correction both on disk and in hard copy (only one hard copy is necessary). Please see a recent issue for correct formatting.

Corrections of a scientific nature (e.g., an incorrect unit of measurement or order of magnitude used throughout; contamination of one of numerous cultures; or misidentification of a mutant strain, causing erroneous data for only a portion [noncritical] of the study) must be sent, both on disk and in hard copy, directly to the editor who handled the article and must be accompanied by signed letters of agreement from all of the authors of the article. If the editor believes that publication is warranted, he will send the correction to the Journals Department for publication. Note that the addition of new data is not permitted.

Retractions

Retractions are reserved for major errors or breaches of ethics that, for example, may call into question the source of the data or the validity of the results and conclusions of an article. Send a Retraction and an accompanying explanatory letter signed by all of the authors directly to the editor in chief of the journal. The editor who handled the paper and the chairman of the ASM Publications Board will be consulted. If all parties agree to the publication and content of the Retraction, it will be sent to the Journals Department for publication.

ILLUSTRATIONS AND TABLES

Illustrations and tables must be submitted electronically along with the text portion of the manuscript. Digital files that are acceptable for production (see below) must be provided for all illustrations, preferably at the submission stage but definitely on return of the modified manuscript. We strongly recommend that authors check the acceptability of their digital images for production by running their files through Rapid Inspector, a tool provided at the following URL: http://rapidinspector.cadmus.com/mw/. Rapid Inspector is an easy-to-use Web-based application that takes only minutes to identify problems that may cause the file to fail at any point during the production process.

Illustrations may be continuous-tone photographs, line drawings, or composites. Color graphics may be submitted, but the cost of printing in color must be borne by the author. Suggestions about how to reduce costs and ensure accurate color reproduction are given below.

In general, digital files are not used for tables at the production stage; however, restrictions on file formats still apply (see the section on Tables below).

Since the contents of computer-generated images can be manipulated for better clarity, the Publications Board at its May 1992 meeting decreed that a description of the software/hardware used should be put in the figure legenda(s).
### Macintosh

<table>
<thead>
<tr>
<th>Application</th>
<th>Black and white</th>
<th>Color (CMYK)</th>
</tr>
</thead>
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<tr>
<td>Adobe Illustrator 6.0, 7.0, 8.0, 9.0, and 10.0</td>
<td>EPS</td>
<td>EPS</td>
</tr>
<tr>
<td>Adobe InDesign 1.0</td>
<td>EPS</td>
<td>EPS</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
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<td>TIFF</td>
<td>EPS</td>
</tr>
<tr>
<td>CorelDRAW 6.0 and 8.0</td>
<td>EPS/EPSTIFF</td>
<td>EPS/EPSTIFF</td>
</tr>
<tr>
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<td>EPS/EPSTIFF</td>
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<td>Macromedia FreeHand 7.0, 8.0, and 9.0</td>
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<td>PowerPoint '98 and 2001</td>
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<td>TIFF</td>
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</tr>
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<td>QuarkXpress</td>
<td>EPS</td>
<td>EPS</td>
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<tr>
<td>Synergy Kaleidagraph 3.08 and 3.51</td>
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<td>N/A</td>
</tr>
</tbody>
</table>

*Color graphics must be saved and printed in the CMYK mode, not RGB.

**ASM accepts only black-and-white, not color, graphics created with Kaleidograph, Adobe Photoshop 5.0 LE, Prism 3 by GraphPad, and PowerPoint.**

**For instructions on saving PowerPoint files, refer to the Cadmus digital art website at http://cjs.cadmus.com/da.**

### Windows

<table>
<thead>
<tr>
<th>Application</th>
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<td>EPS</td>
</tr>
</tbody>
</table>

*Color graphics must be saved and printed in the CMYK mode, not RGB.

**ASM accepts only black-and-white, not color, graphics created with Adobe Photoshop 5.0 LE, Prism 3 by GraphPad, and PowerPoint.**

**For instructions on saving PowerPoint files, refer to the Cadmus digital art website at http://cjs.cadmus.com/da.**

### Illustrations

**File types and formats.** We encourage all authors to supply their illustrations as TIFF or EPS files from supported applications or as PowerPoint files (black and white only) so that they can be used for production if the manuscript is accepted. Except for figures produced in PowerPoint, all graphics submitted must be bitmap, grayscale, or CMYK (not RGB). Illustrations may be uploaded as PDF files only at the submission stage, and the author must specify that they are for reviewing purposes only. Acceptable file types and formats for production are given in the tables above. More-detailed instructions for preparing illustrations are available on the World Wide Web at http://cjs.cadmus.com/da. Please review this information before preparing your files. If you require additional information, please send an e-mail inquiry to digitalart@cadmus.com.

**Minimum resolution.** It is extremely important that a high enough resolution is used. Note, however, that the higher the resolution, the larger the file and the longer the upload time. Minimum resolutions are as follows:

- 300 dpi for grayscale and color
- 600 dpi for lettering
- 1,200 dpi for line art

Resolution requirements do not apply to graphics created in PowerPoint.

**Size.** All graphics MUST be submitted at their intended publication size; that is, the image uploaded should be 100% of its print dimensions so that no reduction or enlargement is necessary. *(No enlargements or reductions will be made by the ASM editorial staff or the printer.)* Include only the significant portion of an illustration. White space must be cropped from the image, and excess space between panel labels and the image must be eliminated.

- Maximum width for a 1-column figure: 3/16 inches
- Maximum width for a 2-column figure: 6/16 inches
- Minimum width for a 2-column figure: 4 1/4 inches
- Maximum depth: 9/16 inches

**Contrast.** Illustrations must contain sufficient contrast to withstand the inevitable loss of contrast and detail inherent in the printing process. See also the section on color illustrations below.

**Labeling and assembly.** All final lettering, labeling, tooling, etc., MUST be incorporated into the figures. It cannot be added at a later date. Do not include the figure number in the image. The order in which the figures appear in the manuscript PDF file will reflect the figure number. Each figure must be uploaded as a separate file, and any multipanel figures must be assembled into one file; i.e., rather than sending a separate file for each panel in a figure, assemble all panels in one piece and supply them as one file.

**Fonts.** To avoid font problems, set all type in one of the following Type 1 PostScript fonts: Helvetica, Times
Roman, European PI, Mathematical PI, or Symbol. All fonts other than these five must be converted to paths (or outlines) in the application with which they were created. For font use in PowerPoint images, refer to the Cadmus digital art website, http://cjs.cadmus.com/da.

Compression. Images created with Macintosh applications may be compressed with Stuffit. Images created with Windows applications may be compressed with WINZIP.

Color illustrations. Because the process of placing ink on paper by using printing presses is different from that used to produce a photo print or a laser print and the color rendition on images viewed on a monitor depends to some extent on monitor resolution, some differences in color and contrast between the image you submit and the image printed in the journal or published online will be evident. (Figures showing red or green fluorescence and those with a significant range of colors may be difficult or impossible to reproduce exactly.) Color illustrations must be saved as either TIFF or EPS files, according to the application used (see charts above). The mode of the TIFF or EPS file must be CMYK, not RGB. Graphics in the RGB color space are intended for display on a monitor only and will not separate correctly for printing.

The cost of printing in color must be borne by the author. The current color costs may be accessed from the submission form in Rapid Review. Adherence to the following guidelines, in addition to the general ones above, will help to minimize costs and to ensure color reproduction that is as accurate as possible.

Include only the significant portions of illustrations so that the number of printed pages containing color figures is minimized. The individual panels of a single figure must be assembled in a single file, including any necessary labels. Optimal color reproduction will be obtained if the composites comprise panels containing similar colors of similar lightness or darkness. If necessary, make unlike panels into separate figures/files; this will increase the cost, but the color rendition will be more accurate since the two panels will be “scanned” separately.

Drawings

Submit graphs, charts, complicated chemical or mathematical formulas, diagrams, and other drawings as finished products not requiring additional artwork or typesetting. No part of the graph or drawing may be handwritten. All elements, including letters, numbers, and symbols, must be clearly readable, and both axes of a graph must be labeled. Keep in mind that the journal is published both in print and online and that the same electronic files submitted by the authors are used to produce both.

When creating line art, please use the following guidelines:

1. All art MUST be submitted at its intended publication size. (No enlargements or reductions will be made by the ASM editorial staff or the printer.) For acceptable dimensions, see the Size section on p. xii.

2. Avoid using screens (i.e., shading) in line art. It can be difficult and time-consuming to reproduce these images without moiré patterns. Various pattern backgrounds are preferable to screens as long as the fill patterns are not imported from another application. If you must use images containing screens,

   • Generate the image at line screens of 85 lines per inch or lower.
   • When applying multiple shades of gray, differentiate the gray levels by at least 20%.
   • Never use levels of gray below 20% or above 70% as they will fade out or become totally black upon scanning and reduction.

3. Use thick, solid lines that are no finer than 1 point in thickness.

4. No type should be smaller than 9 point at the final publication size.

5. Avoid layering type directly over shaded or textured areas.

6. Avoid the use of reversed type (white lettering on a black background).

7. Avoid heavy letters, which tend to close up, and unusual symbols, which the printer may not be able to reproduce in the legend.

8. If colors are used, avoid using similar shades of the same color and avoid very light colors.

In figure ordinate and abscissa scales (as well as table column headings), avoid the ambiguous use of numbers with exponents. Usually, it is preferable to use the appropriate Système International d’Unités (SI) symbols (µ for 10⁻⁶, m for 10⁻³, k for 10³, M for 10⁶, etc.). A complete listing of SI symbols can be found in the International Union of Pure and Applied Chemistry (IUPAC) “Manual of Symbols and Terminology for Physicochemical Quantities and Units” (Pure Appl. Chem. 21:3–44, 1970). Thus, representation of 20,000 cpm on a figure ordinate should be made by the number 20 accompanied by the labelkcpm.

When powers of 10 must be used, the journal requires that the exponent power be associated with the number shown. In representing 20,000 cells per ml, the numeral on the ordinate would be “2” and the label would be “10⁴ cells per ml” (not “cells per ml x
10^{-4}$). Likewise, an enzyme activity of 0.06 U/ml would be shown as 6 accompanied by the label $10^{-2}$ U/ml. The preferred designation would be 60 mU/ml (milliunits per milliliter).

Presentation of Nucleic Acid Sequences

Nucleic acid sequences of limited length which are the primary subject of a study may be presented freestyle in the most effective format. Longer nucleic acid sequences must be presented as figures in the following format to conserve space. Print the sequence in lines of approximately 100 to 120 nucleotides in a nonproportional (monospace) font that is easily legible when published with a line length of 6 inches. If possible, lines of nucleic acid sequence should be further subdivided into blocks of 10 or 20 nucleotides by spaces within the sequences or by marks above it. Uppercase and lowercase letters may be used to designate the exon-intron structure, transcribed regions, etc., if the lowercase letters remain legible at a 6-inch line length. Number the sequence line by line; place numerals, representing the first nucleotide of each codon, by spaces within the sequences or by marks above it. Annotation may include boldface, underlining, brackets, boxes, etc. Encoded amino acid sequences may be presented, if necessary, immediately above or below the first nucleotide of each codon, by using the single-letter amino acid symbols. Comparisons of multiple nucleic acid sequences should conform as nearly as possible to the same format.

Figure Legends

Legends should provide enough information so that the figure is understandable without frequent reference to the text. However, detailed experimental methods must be described in the Materials and Methods section, not in a figure legend. A method that is unique to one of several experiments may be reported in a legend only if the discussion is very brief (one or two sentences). Define all symbols used in the figure and define all abbreviations that are not used in the text.

Tables

Tables that contain artwork, chemical structures, or shading must be submitted as illustrations in an acceptable format. Otherwise, they must be submitted either as Word, WordPerfect, or Acrobat PDF files. Note that a straight Excel file is not an acceptable format. Excel files must either be embedded in a Word or WordPerfect document or be converted to PDF files before being uploaded. Although PDF files and word processing files with embedding are not generally acceptable for production purposes, they are acceptable for tables. To allow them to pass through the file upload and conversion process, select “for reviewing purposes only” at the prompt regardless of their actual purpose. Unlike the other parts of a manuscript, tables are not produced from the author’s source file. They must be rekeyed by the printer before going into a page composition program.

Tables should be formatted as follows. Arrange the data so that columns of like material read down, not across. The headings should be sufficiently clear so that the meaning of the data is understandable without reference to the text. See the Abbreviations section (p. xvii) of these Instructions for those that should be used in tables. Explanatory footnotes are acceptable, but more extensive table “legends” are not. Footnotes should not include detailed descriptions of the experiment. Tables must include enough information to warrant table format; those with fewer than six pieces of data will be incorporated into the text by the copy editor. Table 1 is an example of a well-constructed table.

<table>
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<tbody>
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<td></td>
<td>Total enzyme&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Sp act (U/mg of protein)</td>
</tr>
<tr>
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</tr>
<tr>
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<tr>
<td>Creatinine</td>
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<td>58.40</td>
</tr>
</tbody>
</table>

<sup>a</sup> The inoculum was grown in glucose broth with ammonium sulfate, washed twice, and then transferred into the media with the N sources listed above.

<sup>b</sup> Enzyme units in cell extract obtained from ca. 10<sup>10</sup> cells.

Cover Photographs and Drawings

JB publishes photographs and drawings on the front cover. Invitations are issued to authors whose manuscripts are returned for modification or whose manuscripts have been accepted for publication in JB; material should be related to the work presented in the manuscript. Unsolicited material will also be considered, however. No material submitted for consideration will be returned to the author. Copyright for the chosen material must be transferred to ASM. A short description of the cover material will be included at the end of the table of contents or the author index of the issue. Technical specifications for submissions will be provided with the invitation and are also available from ASM.

NOMENCLATURE

Chemical and Biochemical Nomenclature

The recognized authority for the names of chemical compounds is Chemical Abstracts (Chemical Abstracts Service, Ohio State University, Columbus) and its indexes. The Merck Index, 13th ed. (Merck & Co., Inc.,
Whitehouse Station, N.J., 2001), is also an excellent source. For guidelines to the use of biochemical terminology, consult Biochemical Nomenclature and Related Documents (1978; reprinted for The Biochemical Society, London, England) and the instructions to authors of the Journal of Biological Chemistry and the Archives of Biochemistry and Biophysics (first issues of each year).

Do not express molecular weight in daltons; molecular weight is a unitless ratio. Molecular mass is expressed in daltons.

For enzymes, use the recommended (trivial) name assigned by the Nomenclature Committee of the International Union of Biochemistry (IUB) as described in Enzyme Nomenclature (Academic Press, Inc., New York, N.Y., 1992). If a nonrecommended name is used, place the proper (trivial) name in parentheses at first use in the abstract and text. Use the EC number when one has been assigned, and express enzyme activity either in katal (preferred) or in the older system of micromoles per minute.

Nomenclature of Microorganisms

Binary names, consisting of a generic name and a specific epithet (e.g., Escherichia coli), must be used for all microorganisms. Names of categories at or above the genus level may be used alone, but specific and subspecific epithets may not. A specific epithet must be preceded by a generic name, written out in full the first time it is used in a paper. Thereafter, the generic name should be abbreviated to the initial capital letter (e.g., E. coli), provided there can be no confusion with other genera used in the paper. Names of all taxa (kingdoms, phyla, classes, orders, families, genera, species, and subspecies) are printed in italics and should be underlined (or italicized) in the manuscript; strain designations and numbers are not. Vernacular (common) names should be in lowercase roman type (e.g., streptococcus, brucella). For Salmonella, genus, species, and subspecies names should be rendered in standard form: Salmonella enterica at first use, S. enterica thereafter; Salmonella enterica subsp. arizonae at first use, S. enterica subsp. arizonae thereafter. Names of serovars should be in roman type with the first letter capitalized: Salmonella enterica serovar Typhi-murium. After the first use, the serovar may also be given without a species name: Salmonella serovar Typhi-murium. For other information regarding serovar designations, see Identification and Serotyping of Salmonella and an Update of the Kaufman-White Scheme (A. C. McWhorter-Murlin and F. W. Hickman-Brenner, Centers for Disease Control and Prevention, Atlanta, Ga., 1994) and Antigenic Formulas of the Salmonella Serovars (M. Y. Popoff and L. Le Minor, WHO Collaborating Centre for Reference and Research on Salmonella, Institut Pasteur, Paris, France, 1997).

The spelling of bacterial names should follow the Approved Lists of Bacterial Names (amended edition) (V. B. D. Skerman, V. McGowan, and P. H. A. Sneath, ed., American Society for Microbiology, 1989) and the validation lists published in the International Journal of Systematic and Evolutionary Microbiology (formerly the International Journal of Systematic Bacteriology) since January 1989. In addition, two sites on the World Wide Web list current approved bacterial names: Bacterial Nomenclature Up-to-Date (http://www.dsmz.de/bactnom/bactname.htm) and List of Bacterial Names with Standing in Nomenclature (http://www.bacterio.cict.fr). If there is reason to use a name that does not have standing in nomenclature, the name should be enclosed in quotation marks and an appropriate statement concerning the nomenclatural status of the name should be made in the text.

Microorganisms, viruses, and plasmids should be given designations consisting of letters and serial numbers. It is generally advisable to include a worker’s initial or a descriptive symbol of locale, laboratory, etc., in the designation. Each new strain, mutant, isolate, or derivative should be given a new (serial) designation. This designation should be distinct from those of the genotype and phenotype, and genotypic and phenotypic symbols should not be included. Plasmids are named with a lowercase “p” followed by the designation in uppercase letters and numbers. To avoid the use of the same designation as that of a widely used strain or plasmid, check the designation against a publication database such as Medline.

Genetic Nomenclature

To facilitate accurate communication, it is important that standard genetic nomenclature be used whenever possible and that deviations or proposals for new naming systems be endorsed by an appropriate authoritative body. Review and/or publication of submitted manuscripts that contain new or nonstandard nomenclature may be delayed by the editor or the Journals Department so that they may be reviewed by the Nomenclature Committee of the ASM Publications Board.

Bacteria. The genetic properties of bacteria are described in terms of phenotypes and genotypes. The phenotype describes the observable properties of an organism. The genotype refers to the genetic constitution of an organism, usually in reference to some standard wild type. The guidelines that follow are based on the recommendations of Demerec et al. (Genetics 54:61–76, 1966).

(i) Phenotypic designations must be used when mutant loci have not been identified or mapped. They can also be used to identify the protein product of a gene, e.g., the OmpA protein. Phenotypic designations generally consist of three-letter symbols; these are not italicized, and the first letter of the symbol is capitalized. It is preferable to use Roman or Arabic numerals (instead of letters) to identify a series of related phenotypes. Thus, nucleic acid polymerase mutants might be designated Pol1, Pol2, Pol3, etc. Wild-type characteristics can be designated with a superscript plus (Pol1+), and, when necessary for clarity, negative superscripts (Pol1−) can be used to designate mutant characteristics. Lowercase su-
phasis on certain lori and an exogenote is shown as, for example, pSC101 at zero kilobases (0 kb) is shown as pSC101 Ω(0kb::K-12hisB)4.

(ii) A provisional genotypic designation is also indicated by a hybrid protein is synthesized. An inversion is shown as IN(rrmD-rrmE)/H9024. An insertion of an E. coli his gene into plasmid pSC101 in which a mobile element was inserted and subsequently deleted that this fact be noted in the strain table. This can be done by listing the genotype of the strain used as an intermediate in a table footnote or by making a direct or parenthetical remark in the genotype, e.g., (F'Δ). ΔMu cts, or mal::ΔMu cts: lac. In setting parenthetical remarks within the genotype or dividing the genotype into constituent elements, parentheses and brackets are used without special meaning; brackets are used outside parentheses. To indicate the presence of an episome, parentheses (or brackets) are used (λ, F'). Reference to an integrated episome is indicated as described for inserted elements, and an exogenote is shown as, for example, W3110/F'8(gal+) .


Conventions for naming genes. It is recommended that (entirely) new genes be given names that are mnemonics of their function, avoiding names that are already assigned and earlier or alternative gene names, irrespective of the bacterium for which such assignments have been made. Similarly, it is recommended that, whenever possible, homologous genes present in different organisms receive the same name. When homology is not apparent or the function of a new gene has not been established, a provisional name may be given by one of the following methods. (i) The gene may be named on the basis of its map location in the style yaaA, analogous to the style used for recording transposon insertions (zef) as discussed below. A list of such names in use for E. coli has been published by Rudd (Microbiol. Mol. Biol. Rev. 62:985–1019, 1998). (ii) A provisional name may be given in the style described by Demerec et al. (e.g., usg, gene upstream of folC). Such names should be unique, and names such as orf or genX should not be used. For reference, the E. coli Genetic Stock Center's
“Mutant” versus “mutation.” Keep in mind the distinction between a mutation (an alteration of the primary sequence of the genetic material) and a mutant (a strain carrying one or more mutations). One may speak about the mapping of a mutation, but one cannot map a mutant. Likewise, a mutant has no genetic locus, only a phenotype.

“Homology” versus “similarity.” For use of terms that describe relationships between genes, consult the articles by Theissen (Nature 415:741, 2002) and Fitch (Trends Genet. 16:227–231, 2000). “Homology” implies a relationship between genes that share a common evolutionary origin; partial homology is not recognized. When sequence comparisons are discussed, it is more appropriate to use the term “percent sequence similarity” or “percent sequence identity,” as appropriate.

Strain designations. Do not use the genotype as a name (e.g., “subsequent use of leuC6 for transduction”). If a strain designation has not been chosen, select an appropriate word combination (e.g., “another strain containing the leuC6 mutation”).

Bacteriophages. The genetic nomenclature for phages differs from that for bacteria and tends to have separate conventions for each phage. Genetic symbols may be one, two, or three letters and are italicized. For example, a mutant strain of λ might be designated λ Aam11 int2 red114 cl857; this strain carries mutations in genes cI, int, and red and an amber-suppressible (am) mutation in gene A. Phenotypic symbols and designations of gene products are not italicized (e.g., “the Spi phenotype” or “Int protein”), and superscript plus and minus symbols can be used to indicate wild-type and mutant phenotypes, respectively. Host DNA insertions into phages should be delineated by square brackets, and the genetic symbols and designations for such inserted DNA should conform to those used for the host genome. Lists of gene symbols may be alphabetical or numerical, the latter being preferred.

Transposable elements, plasmids, and restriction enzymes. Nomenclature of transposable elements (insertion sequences, transposons, phage Mu, etc.) should follow the recommendations of Campbell et al. (Gene 5: 197–206, 1979), with the modifications given in section vi above. The Internet site where insertion sequences of eubacteria and archaeabacteria are described and new sequences can be recorded is http://www-is.biotoul.fr/is.html.

Tetracycline resistance determinants. The nomenclature for tetracycline resistance determinants is based on the proposal of Levy et al. (Antimicrob. Agents Chemother. 43:1523–1524, 1999). The style for such determinants is, e.g., Tet B; the space helps distinguish the determinant designation from that for phenotypes and proteins (TetB).

ABBREVIATIONS AND CONVENTIONS

Verb Tense

ASM strongly recommends that for clarity you use the past tense to narrate particular events in the past, including the procedures, observations, and data of the study that you are reporting. Use the present tense for your own general conclusions, the conclusions of previous researchers, and generally accepted facts. Thus, most of the abstract, Materials and Methods, and Results will be in the past tense, and most of the introduction and some of the Discussion will be in the present tense. Be aware that it may be necessary to vary the tense in a single sentence. For example, it is correct to say “White (30) demonstrated that XYZ cells grow at pH 6.8.” “Figure 2 shows that ABC cells failed to grow at room temperature,” and “Air was removed from the chamber and the mice died, which proves that mice require air.” In reporting statistics and calculations, it is
correct to say “The values for the ABC cells are statistically significant, indicating that the drug inhibited . . .”

For an in-depth discussion of tense in scientific writing, see p. 207–209 in How To Write and Publish a Scientific Paper, 5th ed.

Abbreviations

General. Abbreviations should be used as an aid to the reader, rather than as a convenience to the author, and therefore their use should be limited. Abbreviations other than those recommended by the IUPAC-IUB (Biochemical Nomenclature and Related Documents, 1978) should be used only when a case can be made for necessity, such as in tables and figures.

It is often possible to use pronouns or to paraphrase a long word after its first use (e.g., “the drug” or “the substrate”). Standard chemical symbols and trivial names or their symbols (folate, Ala, Leu, etc.) may also be used.

It is strongly recommended that all abbreviations except those listed below be introduced in the first paragraph in Materials and Methods. Alternatively, define each abbreviation and introduce it in parentheses the first time it is used; e.g., “cultures were grown in Eagle minimal essential medium (MEM).” Generally, eliminate abbreviations that are not used at least three times in the text (including tables and figure legends).

Not requiring introduction. In addition to abbreviations for Système International d’Unités (SI) units of measurement, other common units (e.g., bp, kb, and Da), and chemical symbols for the elements, the following should be used without definition in the title, abstract, text, figure legends, and tables: DNA (deoxyribonucleic acid); cDNA (complementary DNA); RNA (ribonucleic acid); cRNA (complementary RNA); RNase (ribonuclease); DNase (deoxyribonuclease); rRNA (ribosomal RNA); mRNA (message RNA); tRNA (transfer RNA); AMP, ADP, ATP, dAMP, ddATP, GTP, etc. (for the respective 5’ phosphates of adenosine and other nucleosides) (add 2′-, 3′-, or 5′- when needed for contrast); ATPase, dGTPase, etc. (adenosine triphosphatase, deoxyguanosine triphosphatase, etc.); NAD (nicotinamide adenine dinucleotide); NAD+ (nicotinamide adenine dinucleotide, oxidized); NADH (nicotinamide adenine dinucleotide, reduced); NADP (nicotinamide adenine dinucleotide phosphate); NADPH (nicotinamide adenine dinucleotide phosphate, reduced) NADP+ (nicotinamide adenine dinucleotide phosphate oxidized); poly(A), poly(dT), etc. (polyadenylic acid, polydeoxythymidylic acid, etc.); oligo(dT), etc. (oligodeoxythymidylic acid, etc.); UV (ultraviolet); PFU (plaque-forming units); CFU (colony-forming units); MIC (minimal inhibitory concentration); Tris [tris(hydroxymethyl)aminomethane]; DEAE (diethylaminoethyl); EDTA (ethylenediaminetetraacetic acid); EGTA [ethylene glycol-bis(β-aminooxyethyl ether)-N,N,N’,N’-tetraacetic acid]; HEPES (N-2-hydroxyethylpiperazine-N’-2-ethanesulfonic acid); PCR (polymerase chain reaction); and AIDS (acquired immunodeficiency syndrome). Abbreviations for cell lines (e.g., HeLa) also need not be defined.

The following abbreviations should be used without definition in tables:

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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Colony-forming units</td>
</tr>
<tr>
<td>MIC</td>
<td>Minimal inhibitory concentration</td>
</tr>
<tr>
<td>poly(A), poly(dT)</td>
<td>Polyadenylic acid, polydeoxythymidylic acid, etc.</td>
</tr>
<tr>
<td>Tris</td>
<td>Tris(hydroxymethyl)aminomethane</td>
</tr>
<tr>
<td>DEAE</td>
<td>Diethylaminoethyl</td>
</tr>
<tr>
<td>EDTA</td>
<td>Ethylenediaminetetraacetic acid</td>
</tr>
<tr>
<td>EGTA</td>
<td>Ethylene glycol-bis(β-aminooxyethyl ether)-N,N,N’,N’-tetraacetic acid</td>
</tr>
<tr>
<td>HEPES</td>
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</tbody>
</table>

Reporting Numerical Data

Standard metric units are used for reporting length, weight, and volume. For these units and for molarity, use the prefixes m, μ, n, and p for 10⁻³, 10⁻⁶, 10⁻⁹, and 10⁻¹², respectively. Likewise, use the prefix k for 10³. Avoid compound prefixes such as mμ or μμ. Use μg/ml or μg/g in place of the ambiguous ppm. Units of temperature are presented as follows: 37°C or 324 K.

When fractions are used to express units such as enzymatic activities, it is preferable to use whole units, such as “g” or “min,” in the denominator instead of fractional or multiple units, such as μg or 10 min. For example, “pmol/min” is preferable to “nmol/10 min,” and “μmol/g” is preferable to “nmol/μg.” It is also preferable that an unambiguous form such as exponential notation be used; for example, “μmol g⁻¹ min⁻¹” is preferable to “μmol/g/min.” Always report numerical data in the appropriate SI units.

Isotopically Labeled Compounds

For simple molecules, isotopic labeling is indicated in the chemical formula (e.g., ¹⁴CO₂, ³H₂O, and H₂³⁵SO₄). Brackets are not used when the isotopic symbol is attached to the name of a compound that in its natural state does not contain the element (e.g., ³²S-ATP) or to a word that is not a specific chemical name (e.g., ¹³¹I-labeled protein, ¹⁴C-amino acids, and ³H-ligands).

For simple chemicals, the symbol for the isotope introduced is placed in square brackets directly preceding
the part of the name that describes the labeled entity. Note that configuration symbols and modifiers precede the isotopic symbol. The following examples illustrate correct usage:

\[ ^{14}\text{C}\text{urea} \quad [\gamma^{13}\text{P}]\text{ATP} \]

\[ \text{L-}[\text{methyl-}^{14}\text{C}]\text{methionine} \quad \text{UDP-[U-}^{13}\text{C}]\text{glucose} \]

\[ [2,3-^3\text{H}]\text{serine} \quad \text{E. coli [}^{32}\text{P}]\text{DNA} \]

\[ [\alpha-^{14}\text{C}]\text{lysine} \quad \text{fructose 1,6-[1-}^{32}\text{P}]\text{bisphosphate} \]

This journal follows the same conventions for isotopic labeling as the *Journal of Biological Chemistry*, and more detailed information can be found in the instructions to authors of that journal (first issue of each year).

For your convenience, these Instructions are also available through the Internet at the following address: http://www.journals.asm.org.