

APPLIED AND ENVIRONMENTAL MICROBIOLOGY

INSTRUCTIONS TO AUTHORS*

HOW TO SUBMIT MANUSCRIPTS

Submit manuscripts directly to: Journals Department, American Society for Microbiology, 1325 Massachusetts Ave., N.W., Washington, DC 20005-4171. *Since all submissions must be processed through this office, alternate routings, such as to an editor, will delay initiation of the review process.* The manuscript must be accompanied by a cover letter stating the following: the journal to which the manuscript is being submitted; the most appropriate section of the journal; the complete mailing address (including the street), e-mail address (if available), and telephone and fax numbers of the corresponding author; and the former ASM manuscript number and year if it is a resubmission. It is expected that the author will include written assurance that permission to cite unpublished data or personal communications has been granted.

Authors may suggest an appropriate editor for new submissions. If we are unable to comply with such a request, the corresponding author will be notified before the manuscript is assigned to another editor. To expedite the review process, authors may recommend at least two or three reviewers who are not members of their institution(s) and have never been associated with them or their laboratory(ies). Please provide the name, address, phone and fax numbers, and area of expertise for each. Note that reviewers so recommended will be used at the discretion of the editor.

Submit three complete copies of each manuscript, including figures and tables. Incomplete manuscripts may be returned to the author without review. Type every portion of the manuscript **double spaced** (a minimum of 6 mm between lines), including figure legends, table footnotes, and References, and number all pages in sequence, including the abstract, figure legends, and tables. Place the last two items after the References section. Manuscript pages must have margins of at least 1 inch on all four sides and **should have line numbers**. It is recommended that the following sets of characters be easily distinguishable in the manuscript: the numeral zero (0) and the letter "oh" (O); the numeral one (1), the letter "el" (l), and the letter "eye" (I); and a multiplication sign (×) and the letter "ex" (x). If such distinctions cannot be made, please mark these items at the first occurrence for cell lines, strain and genetic designations, viruses, etc., on the modified manuscript so that they may be identified properly for the printer by the copy editor. See p. vii for detailed instructions about illustrations.

Copies of in-press and submitted manuscripts that are important for judgment of the present manuscript

should be enclosed to facilitate the review. Three copies of each such manuscript should be provided.

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Manuscripts may be rejected on the basis of poor English or lack of conformity to accepted standards of style.

Manuscript submission checklist:

- Include three copies of the manuscript
- Attach a single set of original (not photocopy) figures to each manuscript copy
- Double space all text, including references and figure legends
- Number pages
- Number lines
- Present statistical treatment of data where appropriate
- Format references in ASM style
- Indicate journal section for manuscript publication
- Provide accession numbers for all sequences used for phylogenetic comparisons
- Confirm that genetic and chemical nomenclature conforms to instructions

EDITORIAL POLICY

Manuscripts submitted to the journal must represent reports of original research, and the original data must be available for review by the editor if necessary. **All authors of a manuscript must have agreed to its submission and are responsible for its content**, including appropriate citations and acknowledgments, and must also have agreed that the corresponding author has the authority to act on their behalf on all matters pertaining to publication of the manuscript. By submission of a manuscript to the journal, the authors guarantee that they have the authority to publish the work and that the manuscript, or one with substantially the same content, was not published previously, is not being considered or published elsewhere, and was not rejected on scientific grounds by another ASM journal.

By publishing in the journal, the authors agree that any plasmids, viruses, and living materials such as microbial strains and cell lines newly described in the article are available from a national collection or will be made available in a timely fashion and at reasonable cost to members of the scientific community for noncommercial purposes.

Failure to comply with the above-mentioned policies may result in a suspension of publishing privileges in ASM journals and notification of the authors' institutions.

* Shading indicates material that has been added or updated.

Primary Publication

The American Society for Microbiology accepts the definition of primary publication as given in *How to Write and Publish a Scientific Paper*, 4th ed. (Oryx Press, Phoenix, Ariz., 1994), by Robert A. Day, to wit: “. . . (1) the first publication of original research results, (2) in a form whereby peers of the author can repeat the experiments and test the conclusions, and (3) in a journal or other source document [emphasis added] readily available within the scientific community.”

A scientific paper or its substance published in a conference report, symposium proceeding, or technical bulletin, posted on a host computer to which there is access via the Internet, or made available through any other retrievable source, including CD-ROM and other electronic forms, is unacceptable for submission to an ASM journal on grounds of *prior publication*. A manuscript whose substance was included in a thesis or dissertation posted on a host computer to which there is access via the Internet is unacceptable for submission to an ASM journal on the grounds of *prior publication*.

The posting of unpublished sequence data on the Internet is usually not considered prior publication; however, the address (URL) of the source for the sequence should be included in the reference section. A preliminary disclosure of research findings published in abstract form as an adjunct to a meeting, e.g., part of a program, is not considered prior publication because it does not meet the criteria for a scientific paper.

It is incumbent upon the author to acknowledge any prior publication of the data contained in a manuscript submitted to an ASM journal. A copy of the relevant work should accompany the paper.

Permissions

The corresponding author is responsible for obtaining permission from both the original author and the original publisher (i.e., the copyright owner) to reproduce or modify figures and tables and to reproduce text (in whole or in part) from previous publications.

The signed permissions must be submitted to ASM and should be identified as to the relevant item in the ASM manuscript (e.g., “permissions for Fig. 1 in AEM 123-98”). In addition, a statement indicating that the material is being reprinted with permission must be included in the relevant figure legend or table footnote of the manuscript. Reprinted text must be enclosed in quotation marks, and the permission statement must be included as running text or indicated parenthetically.

Prepublication Publicity

An author's work may not be publicized while a manuscript is under review or while it is awaiting publication. Public announcements are embargoed until 12:00 noon ET on the day that the issue in which the article is

appearing is mailed, and ASM must be notified at least 2 working days in advance. Authors interested in publicizing their articles at an earlier date must contact the Director, Journals, for instructions.

Abstracts, posters, seminars, roundtables, etc., presented at scientific meetings are not considered to be publicity. However, if the presenter expects to subsequently submit a paper on the subject to an ASM journal, no tables, figures, or text specifically intended for publication may be given to the media and mention of the presentation should be made in the manuscript.

Authorship

An author is one who made a substantial contribution to the overall design and execution of the experiments; therefore, ASM considers all authors responsible for the entire paper. Individuals who provided assistance, e.g., supplied strains or reagents or critiqued the paper, need not be listed as authors but may be recognized in the Acknowledgments section.

All authors must agree to the order in which their names are listed in the byline. Footnotes regarding attribution of work (e.g., X. Jones and Y. Smith contributed equally to . . .) are not permitted. If necessary, such statements may be included in the Acknowledgments section.

Disputes about authorship may delay review and/or publication of the manuscript.

Warranties and Exclusions

Articles published in this journal represent the opinions of the authors and do not necessarily represent the opinions of ASM. ASM does not warrant the fitness or suitability, for any purpose, of any methodology, kit, product, or device described or identified in an article. The use of trade names is for identification purposes only and does not constitute endorsement by ASM.

Page Charges

Authors whose research was supported by grants, special funds (including departmental and institutional), or contracts (including governmental) or whose research was done as part of their official duties are required to pay page charges. Page charges are currently \$40 per page for the first five pages and \$56 per page for each page in excess of five (prices subject to change). A bill for page charges is sent with the page proofs and reprint order form.

If the research was not supported by any of the means described above, a request to waive the charges may be sent to the Journals Department, American Society for Microbiology, 1325 Massachusetts Ave., N.W., Washington, DC 20005-4171, with the submitted manuscript. This request, which must be separate from the cover letter, must indicate how the work was supported and should be accompanied by copies of the Acknowledgments section and the title page.

Minireviews and Letters to the Editor (see p. vii) are not subject to page charges.

Copyright

To maintain and protect the Society's ownership and rights and to protect the original authors from misappropriations of their work, ASM requires the corresponding author to sign a copyright transfer agreement on behalf of all the authors. This agreement is sent to the corresponding author when the manuscript is accepted and scheduled for publication. Unless this agreement is executed (without changes and/or addenda), ASM will not publish the manuscript.

In the copyright transfer agreement signed by an author, ASM grants to that author (and coauthors) the right to republish *portions* of his (their) article in any other publication (print, CD-ROM, and other electronic forms) of which he is (they are) the author(s) or editor(s), *as long as appropriate credit is given to the original ASM publication*. This republication right also extends to posting on a host computer to which there is access via the Internet. Significant portions or entire articles may *not* be reprinted/posted, however, as this would constitute duplicate publication.

If *all* authors were employed by the U.S. government when the work was performed, the corresponding author should not sign the copyright transfer agreement but should, instead, attach to the agreement a statement attesting that the manuscript was prepared as a part of their official duties and, as such, is a work of the U.S. government not subject to copyright.

If *some* of the authors were employed by the U.S. government when the work was performed but the others were not, the corresponding author should sign the copyright transfer agreement as it applies to that portion performed by the non-government employee authors.

Scope

Applied and Environmental Microbiology (AEM) publishes descriptions of all aspects of applied research as well as research of a genetic and molecular nature that focuses on topics of practical value and basic research on microbial ecology. Research must address salient microbiological principles, fundamental microbial processes, or basic questions in applied or environmental microbiology. Topics that are considered include microbiology in relation to foods, agriculture, industry, biotechnology, public health, plants, and invertebrates and basic biological properties of bacteria, fungi, protozoa, and other simple eucaryotic organisms as related to microbial ecology. Manuscripts should report new and significant findings that advance the understanding of microbiology and upon which other scientists may build.

The **plant microbiology** section will consider manuscripts dealing with all aspects of plant-microorganism interactions, including symbiotic and rhizosphere bacteria and phytopathogenic microorganisms.

New microbiological **methods** must provide novel avenues to address fundamental biological questions and will be considered for publication in AEM when accompanied by a demonstrated application. Descriptions of the application of previously described technologies to a new genus or species of microbe will generally not be considered for independent publication.

Manuscripts submitted to the **mycology** section should be clearly of a microbiological nature and may deal with basic biology, biochemistry, genetics, or physiology of fungi, molds, or yeasts. Papers dealing purely with taxonomy, with fungal structure, or with metabolism/alteration of metabolites/toxins by animal, plant, or insect cells, tissues, or organisms are not suitable. Documentation of the distribution/occurrence of toxins or metabolites in natural samples (foods, cereals, grains, soils, etc.) is suitable if the work includes studies on the isolation, occurrence, or enumeration of the responsible microbes in these samples. The chemical or biochemical elucidation of metabolite or toxin structures is suitable if the work includes aspects of the enzymology or biosynthesis of these compounds.

Invertebrate microbiology manuscripts should address interactions between invertebrates and microorganisms, ranging from commensalism and mutualism to parasitism and pathogenicity. Manuscripts describing work dealing with the metabolites or toxins from animal, plant, or insect cells or the physiology of such cells are not suitable for AEM unless it affects a microbial community or individual microorganisms.

ASM publishes a number of different journals covering various aspects of the field of microbiology. Each journal has a prescribed scope which must be considered in determining the most appropriate journal for each manuscript. The following guidelines may be of assistance.

(i) AEM will consider manuscripts describing properties of enzymes and proteins that are produced by either wild-type or genetically engineered microorganisms and that are significant or have potential significance in industrial or environmental settings. Studies dealing with basic biological phenomena of enzymes or proteins or in which enzymes have been used in investigations of basic biological functions are more appropriate for the *Journal of Bacteriology*.

(ii) AEM will consider papers which describe the use of antimicrobial or anticancer agents as tools for elucidating aspects of applied and environmental microbiology. Other papers dealing with antimicrobial or anticancer agents, including manuscripts dealing with the biosynthesis and metabolism of such agents, are more appropriate for *Antimicrobial Agents and Chemotherapy*.

(iii) Papers on the biology of bacteriophages and other viruses are more appropriate for the *Journal of Virology* or the *Journal of Bacteriology*. AEM does, however, consider manuscripts dealing with viruses in relation to environmental, public health, or industrial microbiology.

(iv) Manuscripts dealing with the immune system or with topics of basic medical interest or oral microbiology are more appropriate for *Infection and Immunity*. Re-

ports of clinical investigations and environmental biology applied to hospitals should be submitted to the *Journal of Clinical Microbiology*.

(v) In most cases, AEM will not consider reports that emphasize nucleotide sequence data alone (without experimental documentation of the functional and evolutionary significance of the sequence).

Questions about these guidelines may be directed to the editor in chief of the journal being considered.

If transfer to another ASM journal is recommended by an editor, the corresponding author will be contacted.

Note that a manuscript rejected by one ASM journal on scientific grounds or on the basis of its general suitability for publication is considered rejected by all other ASM journals.

Culture Deposition

AEM encourages authors to deposit important strains in publicly accessible culture collections and to refer to the collections and strain numbers in the text. Since the authenticity of subcultures of culture collection specimens that are distributed by individuals cannot be ensured, authors should indicate laboratory strain designations and donor source as well as original culture collection identification numbers.

Nucleotide Sequences

It is expected that newly assigned GenBank/EMBL/DDBJ accession numbers for nucleotide and/or amino acid sequence data will be included in the original manuscript or be inserted when the manuscript is modified. The accession number should be included in a separate paragraph at the end of the Materials and Methods section for long-form papers or at the end of the text for short-form papers. If conclusions in a manuscript are based on the analysis of sequences and a GenBank/EMBL/DDBJ accession number is not provided at the time of the review, authors may be required to provide the sequence data as a file on a floppy disk.

It is expected that when previously published sequence accession numbers are cited in a manuscript, the original citations (e.g., journal articles) will be included in the References section when possible or reasonable.

Authors are also expected to do elementary searches and comparisons of nucleotide and amino acid sequences against the sequences in standard databases (e.g., GenBank) immediately before manuscripts are submitted and again at the proof stage.

Database address information is as follows.

DDBJ: DNA Data Bank of Japan, Center for Information Biology, National Institute of Genetics, Mishima, Shizuoka 411, Japan; telephone, 81-559-81-6853; fax, 81-559-81-6849; e-mail, ddbjsub@ddbj.nig.ac.jp (for data submissions); WWW URL, <http://www.ddbj.nig.ac.jp>.

EMBL: EMBL Nucleotide Sequence Submissions, Eu-

ropean Bioinformatics Institute, Hinxton Hall, Hinxton, Cambridge CB10 1SD, United Kingdom; telephone, 44-1223-494401; fax, 44-1223-494472; e-mail, datasubs@ebi.ac.uk; WWW URL, <http://www.ebi.ac.uk>.

GenBank: National Center for Biotechnology Information, National Library of Medicine, Bldg. 38A, Rm. 8N-803, Bethesda, MD 20894; telephone, 301-396-2475; fax, 301-480-9241; e-mail, gb-sub@ncbi.nlm.nih.gov; WWW URL, <http://www.ncbi.nlm.nih.gov>.

See p. ix for nucleic acid sequence formatting instructions.

Editorial Style

The editorial style of ASM journals conforms to the *ASM Style Manual for Journals and Books* (American Society for Microbiology, 1991) and *How to Write and Publish a Scientific Paper*, 4th ed. (Oryx Press, 1994), as interpreted and modified by the editors and the ASM Journals Department. The editors and the Journals Department reserve the privilege of editing manuscripts to conform with the stylistic conventions set forth in the aforesaid publications and in these instructions.

Review Process

All manuscripts are considered to be confidential and are reviewed by the editors, members of the editorial board, or qualified ad hoc reviewers. When a manuscript is submitted to the journal, it is given a number (e.g., AEM 47-98) and assigned to one of the editors. All coauthors are notified of this number and the editor to whom the manuscript has been assigned. (**Always refer to this number in communications with the editor and Journals Department.**) It is the responsibility of the corresponding author to inform the coauthors of the manuscript's status throughout the review and publication processes. The reviewers operate under strict guidelines set forth in "Guidelines for Reviewers" and are expected to complete their reviews within 3 weeks after receiving the manuscript. The corresponding author is notified, an average of 8 weeks after submission, of the editor's decision to accept, reject, or require modification. When a manuscript is returned to the corresponding author for modification, it should be returned to the editor within 2 months; otherwise it may be considered withdrawn. A point-for-point response to the reviews must be included with the revised manuscript; an extra copy of the revised manuscript (without figures) should have the changes highlighted. Manuscripts that have been rejected, or withdrawn after being returned for modification, may be resubmitted if the major criticisms have been addressed. As with initial submissions, resubmitted manuscripts should be sent to the Journals Department, *not to the editor*, and should be accompanied by a cover letter stating that the manuscript is a resubmission. A point-for-point response to the original reviews, as well as a copy of the resubmitted manuscript with the changes highlighted, should be included. Resubmitted manu-

scripts are normally handled by the original editor. Manuscripts cannot be resubmitted more than once unless permission has been obtained from the original editor or from the editor in chief.

Notification of Acceptance

When an editor has decided that a manuscript is acceptable for publication on the basis of scientific merit, it is sent to the Journals Department, where it is checked by the production editor. If the manuscript has been prepared according to the criteria set forth in these instructions, it is scheduled for the next available issue and an acceptance letter that indicates the month of publication, approximate page proof dates, and section is mailed to the corresponding author. The editorial staff of the ASM Journals Department completes the editing of the manuscript to bring it into conformity with prescribed style.

Page Proofs

The printer sends page proofs, the copyedited manuscript, and the page charge/reprint order form to the corresponding author. As soon as the page proofs are corrected and signed by the person who proofread them (within 48 h), they should be mailed to the ASM Journals Department.

The proof stage is not the time to make extensive corrections, additions, or deletions. Important new information that has become available between acceptance of the manuscript and receipt of the proofs may be inserted as an addendum in proof with the permission of the editor. If references to unpublished data or personal communications are added, it is expected that written assurance granting permission for the citation will be included. Limit changes to correction of spelling errors, incorrect data, and grammatical errors and updated information for references to articles that have been submitted or are in press.

Questions about late proofs and problems in the proofs should be directed to the ASM Journals Department (telephone, 202-942-9219).

Reprints

Reprints (in multiples of 100) may be purchased by all coauthors. An order form that includes a table showing the cost of reprints is sent with the proofs to the corresponding author.

ORGANIZATION AND FORMAT

Long-Form Papers

Long-form papers should include the elements described in this section.

Title, running title, and byline. Each manuscript should present the results of an independent, cohesive study; thus, numbered series titles are not permitted. Exercise care in composing a main title. Avoid the main title/subtitle arrangement, complete sentences, and unnecessary articles. On the title page, include the title, running title (not to exceed 54 characters and spaces), name of each author, address(es) of the institution(s) at which the work was performed, each author's affiliation, and a footnote indicating the present address of any author no longer at the institution where the work was performed. Place an asterisk after the name of the author to whom inquiries regarding the paper should be directed, and **give that author's telephone and fax numbers.**

Correspondent footnote. The complete mailing address, telephone number, fax number, and e-mail address (if available) of 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. If these items are not provided on the manuscript title page, the ASM editorial staff will insert the information from the original letter of submission.

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 do not include diagrams. When it is essential to include a reference, use the same format as shown in 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 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 sources and properties of the strains, mutants, bacteriophages, plasmids, etc.

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.

Results. In the Results section, include only 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 to derive kinetic or physical constants (e.g., reduced viscosity plots and plots used to determine sedimentation velocity) 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.

Appendixes. Appendixes, which contain supplementary material to aid the reader, are permitted. Titles, authors, and References sections that are distinct from those of the primary article are not allowed. If it is not feasible to list the author(s) of the appendix in the byline or the Acknowledgments section of the primary article,

rewrite the appendix so that it can be considered for publication as an independent article, either full length or Note style. Equations, tables, and figures should be labeled with the letter “A” preceding the numeral to distinguish them from those cited in the main body of the text.

References. The References section must include **all** relevant sources, and all listed references **must** be cited in the text. Arrange the citations in **alphabetical order**, by first author, and **number consecutively**. Abbreviate journal names according to *BIOSIS Serial Sources* (BioSciences Information Service, Philadelphia, Pa., 1997). Cite each listed reference by number in the text.

Follow the styles shown in the examples below.

1. **Armstrong, J. E., and J. A. Calder.** 1978. Inhibition of light-induced pH increase and O₂ evolution of marine microalgae by water-soluble components of crude and refined oils. *Appl. Environ. Microbiol.* **35**:858–862.
2. **Barton, B., G. Harding, and A. Zuccarelli.** 1994. A general method for detecting and sizing large plasmids, abstr. H-249, p. 244. *In* Abstracts of the 94th General Meeting of the American Society for Microbiology 1994. American Society for Microbiology, Washington, D.C.
3. **Berry, L. J., R. N. Moore, K. J. Goodrum, and R. E. Couch, Jr.** 1977. Cellular requirements for enzyme inhibition by endotoxin in mice, p. 321–325. *In* D. Schlessinger (ed.), *Microbiology—1977*. American Society for Microbiology, Washington, D.C.
4. **Cox, C. S., B. R. Brown, and J. C. Smith.** *J. Gen. Genet.*, in press.* [*Article title is optional.*]
5. **Finegold, S. M., W. E. Shepherd, and E. H. Spaulding.** 1977. Cumitech 5, Practical anaerobic bacteriology. Coordinating ed., W. E. Shepherd. American Society for Microbiology, Washington, D.C.
6. **Fitzgerald, G., and D. Shaw.** *In* A. E. Waters (ed.), *Clinical microbiology*, in press. EFH Publishing Co., Boston, Mass. [*Chapter title is optional.*]
7. **Gill, T. J., III.** 1976. Principles of radioimmunoassay, p. 169–171. *In* N. R. Rose and H. Friedman (ed.), *Manual of clinical immunology*. American Society for Microbiology, Washington, D.C.
8. **Gustlethwaite, F. P.** 1985. Letter. *Lancet* **ii**:327.
9. **Jacoby, J., R. Grimm, J. Bostic, V. Dean, and G. Starke.** Submitted for publication. [*Article title is optional.*]
10. **Jensen, C., and D. S. Schumacher.** Unpublished data. [*Date is optional.*]
11. **Jones, A.** Personal communication. [*Date is optional.*]
12. **Leadbetter, E. R.** 1974. Order II. *Cytophagales* nomen novum, p. 99. *In* R. E. Buchanan and N. E. Gibbons (ed.), *Bergey’s manual of determinative bacteriology*, 8th ed. The Williams & Wilkins Co., Baltimore, Md.
13. **Sacks, L. E.** 1972. Influence of intra- and extracellular cations on the germination of bacterial spores, p. 437–442. *In* H. O. Halvorson, R. Hanson, and L. L. Campbell (ed.), *Spores V*. American Society for Microbiology, Washington, D.C.
14. **Sigma Chemical Co.** 1989. Sigma manual. Sigma Chemical Co., St. Louis, Mo.
15. **Smith, J. C.** April 1970. U.S. patent 484,363,770.
16. **Smyth, D. R.** 1972. Ph.D. thesis. University of California, Los Angeles. [*Title is optional.*]
17. **Yagupsky, P., and M. A. Menegus.** 1989. Intraluminal col-

onization as a source of catheter-related infection. *Antimicrob. Agents Chemother.* **33**:2025. (Letter.)

* Note that a reference to an in-press ASM publication should state the control number (e.g., AEM 576-98) if it is a journal article or the name of the publication if it is a book.

Short-Form Papers

Submit short-form papers in the same way as long-form papers. They receive the same review, they are not published more rapidly than long-form papers, and they are not considered preliminary communications. This format is intended for the presentation of brief observations that do not warrant long-form papers.

The title, running title (not to exceed 54 characters and spaces), byline, and correspondent footnote should be prepared as for the long-form paper. Each short-form paper must have an **abstract of no more than 50 words**. Do not use section headings in the body of the paper; report 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 figure legends or table footnotes**. Present acknowledgments as in long-form papers, but do not use a heading. The References section is identical to that of long-form papers.

Minireviews

Minireviews are brief summaries (**limit of 6 printed pages exclusive of references**) of developments in fast-moving areas. They must be based on published articles; they may address any subject within the scope of AEM. Minireviews may be either solicited or proffered by authors responding to a recognized need. Irrespective of origin, minireviews are subject to editorial review. Three double-spaced copies must be provided.

Letters to the Editor

Letters to the Editor must cite published references to support the writer's argument and are intended only for comments on articles published previously in the journal. They may be **no more than 500 words long**. Send three copies to the Journals Department. The letter will be processed and sent to the editor who handled the article in question. If the editor believes that publication is warranted, he will solicit a reply from the corresponding author of the article and make a recommendation to the editor in chief. Final approval for publication rests with the editor in chief. All letters intended for publication must be **typed double spaced**.

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, mislabeling in a figure) of a published article. Send errata directly to the Journals Department.

Author's 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 or 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 to publication of the correction. Letters from both parties must accompany the correction and be sent directly to the Journals Department.

Corrections of a scientific nature (e.g., an incorrect unit of measurement or order of magnitude used throughout; contamination of one of numerous cultures; misidentification of a mutant or strain, causing erroneous data for only a portion [noncritical] of the study) must be sent directly to the editor who handled 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.

Disclaimers

Statements disclaiming governmental or any other type of endorsement or approval will be deleted by the Journals Department.

ILLUSTRATIONS AND TABLES

The figure number and authors' names should be written on all figures, either in the margin or on the back (marked lightly with a soft pencil). For micrographs especially, the top should be indicated as well.

Do not cite references by number in camera-ready copy; the numbering may change when the manuscript is copyedited.

Do not clasp figures to each other or to the manuscript with paper clips. Insert small figures in an envelope. To avoid damage in transit, do not submit illustrations larger than 8½ by 11 inches.

Illustrations in published articles will not be returned to authors.

Continuous-Tone and Composite Photographs

When submitting continuous-tone photographs (e.g., polyacrylamide gels), keep in mind the journal page width: 3⁵/₁₆ inches for a single column and 6¹⁵/₁₆ inches for a double column (maximum). Include only the significant portion of an illustration. Photos must be of sufficient contrast to withstand the inevitable loss of contrast and detail inherent in the printing process. **Submit one photograph of each continuous-tone figure for each copy of the manuscript; photocopies are not acceptable.** If possible, the figures submitted should be the size they will appear when published so that no reduction is necessary. If they must be reduced, make sure that *all* elements, including labeling, can withstand reduction and remain legible.

If a figure is a composite of a continuous-tone photograph and a drawing or labeling, the **original composite** (i.e., not a photograph of the composite) **must be provided** for the printer. This original, labeled “printer’s copy,” may be sent with the modified manuscript to the editor. Composites should be mounted on lightweight flexible backing, not on heavy cardboard.

Electron and light micrographs must be direct copies of the original negative. Indicate the magnification with a scale marker on each micrograph.

Color Photographs and Illustrations

The cost of printing in color must be borne by the author. Adherence to the following guidelines will help to minimize costs and to ensure color reproduction that is as accurate as possible.

Keep in mind the journal page width (3⁵/₁₆ inches for a single column and 6¹⁵/₁₆ inches for a double column) and height (9¹/₁₆ inches) and submit figures at the size they should appear when published so that no reduction is necessary. Include only the significant portions of illustrations so that the number of printed pages containing color figures is minimized. Make sure that all edges are straight and corners are square. To reduce the cost, mount separate panels together as a composite “plate” when possible and add any necessary labels and tooling (i.e., thin white lines between the parts) that is of even width. Composites should be mounted on lightweight flexible backing so that they can be wrapped around a scanner drum. (If a composite is mounted on a heavy board and cannot be wrapped on the drum, a transparency will have to be produced, at additional cost.)

For optimal color reproduction, plates should com-

prise parts containing similar colors of similar lightness or darkness. If necessary, separate unlike photos on a single plate into two separate plates; this will increase the cost, but the color rendition will be more accurate since the two plates will be scanned separately.

See also “Computer-Generated Images,” below.

Computer-Generated Images

At this time, the **highest-quality** and simplest reproduction of gels (and similar illustrations) continues to result from **scanning of author-supplied continuous-tone photographs** by the printer.

Images produced by authors’ desktop systems are digitized and printed as patterns of dots. This also requires that the images be broken up into a dot pattern. Performing this process twice results in degradation of image quality and resolution. It is possible to use prints produced by desktop systems, but they will have to be scanned slightly out of focus to avoid interference of the dot patterns, and thus ASM cannot guarantee the quality of their reproduction. There are two alternatives. The first requires substitution of these images with continuous-tone photographs of the figures in question; these can be scanned normally and will produce the best-quality printed photographs, as mentioned above. The second alternative is to submit illustrations electronically. Should you be interested in this second alternative, please read the instructions provided below **and** those given on the World Wide Web at <http://cadmus.com/da>.

At the time of submission, submit **only** hard-copy printouts of each figure. With the revised manuscript, submit **both** a hard copy of each figure and a disk. The hard copy **MUST** match the figure on the disk *exactly* (both content and size). Failure to submit hard copy or submission of a copy that does not match the disk version exactly will result in a delay of publication. The type of software used and the number of images stored must be indicated on each disk.

Black-and-white graphics should be saved as TIFF or EPS files (except for those created with Deneba Canvas, which must be saved **only** as EPS files), and color graphics should be saved as EPS files in the CMYK mode. Currently, ASM will accept digital art created only with a graphics program listed below:

Macintosh

Adobe Illustrator 6.0
 Adobe Photoshop 3.0, 4.0
 Deneba Canvas 5.0
 Macromedia FreeHand 7.0
 QuarkXPress 3.32
 Kaleidograph 3.08

Windows 3.1, Windows 95, and Windows NT 4.0

Adobe Photoshop 4.0
 Macromedia FreeHand 7.0
 QuarkXPress 3.32

Images produced with other types of software will NOT be accepted; ASM will instead use the hard copy submitted with the disk.

See below for information on media, compression, resolution, and size:

Acceptable media

3.5-inch floppy disks
44-, 88-, or 200-MB SyQuest disks
650-MB magneto-optical disks
Iomega Zip disks
CD-ROM

(Note that disks and CD-ROMs will not be returned to the author.)

Acceptable compression

PKZIP or WINZIP for Windows
Stuffit for Macintosh
Any self-extracting compression software

Minimum resolution

300 dpi for gray scale and color
600 dpi for lettering
1,200 dpi for line art

Size

All graphics **MUST** be submitted at their **actual size**; that is, they should be 100% of their print dimensions so that no scaling is necessary.

Maximum width for a 1-column figure: $3\frac{5}{16}$ inches
Maximum width for a 2-column figure: $6\frac{15}{16}$ inches
Minimum width for a 2-column figure: $4\frac{1}{8}$ inches

Make sure that any multipanel figures are 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.

Label and lock the disk. Never send the only copy of a file. All final lettering, labeling, tooling, etc., **MUST** be incorporated into the final supplied figures. It cannot be added at a later date. To avoid font problems, all type should be set in either Helvetica or Times New Roman. All type set in illustration programs should be converted to paths or outlines to ensure the quality of the type without requiring that any fonts be sent. Do **NOT** use complex paths, areas that require trapping, or RGB files.

If you require further information, please send an e-mail inquiry to digitalart@cadmus.com. Inquiries will be answered within 48 h, during normal business hours.

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

Drawings

Submit graphs, charts, complicated chemical or mathematical formulas, diagrams, and other drawings as glossy photographs made from finished drawings not requiring additional artwork or typesetting. Computer-generated graphics produced on high-quality laser printers are also usually acceptable. No part of the graph or drawing should be handwritten. Both axes of graphs must be labeled. Most graphs will be reduced to one-column width ($3\frac{5}{16}$ inches), and *all* elements in the drawing should be large enough to withstand this reduction. Avoid heavy letters, which tend to close up when reduced, and unusual symbols, which the printer may not be able to reproduce in the legend. If different gradations of shading are used, make sure that they are significant enough to be differentiated easily after the figure is reduced. For bar graphs, cross-hatching is preferable to stippling.

In figure ordinate and abscissa scales (as well as table column headings), avoid ambiguous use of numbers with exponents. Usually, it is preferable to use the Système International d'Unités (SI) symbols (μ for 10^{-6} , m for 10^{-3} , k for 10^3 , M for 10^6 , 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, a representation of 20,000 dpm on a figure ordinate is to be made by the number 20 accompanied by the label kdpm.

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 $\times 10^{-4}$ "). 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 in the following format to conserve space. Submit the sequence as camera-ready copy with dimensions of $8\frac{1}{2}$ by 11 inches (or slightly less) in standard (portrait) orientation. Print the sequence in lines of 100 bases, each in a nonproportional (monospace) font which is easily legible when published at 100 bases/6 inches. Uppercase and lowercase letters may be used to designate the exon-intron structure, transcribed regions, etc., if the lowercase letters remain legible at 100 bases/6 inches. Number the sequence line by line; place numerals, representing the first base of each line, to the left of the lines. **Minimize spacing between lines of sequence,**

leaving room only for annotation of the sequence. 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

Type each table on a separate page. 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 "Abbreviations" in 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. A well-constructed table is shown above.

Tables that can be photographically reproduced for publication without further typesetting or artwork are referred to as "camera ready." They should not be hand lettered and must be carefully prepared to conform with the style of the journal. The advantage of submitting camera-ready copy is that the material will appear exactly as envisioned by the author and no second proof-reading is necessary. This is particularly advantageous when there are long, complicated tables and when the division of material and spacing are important.

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*, 11th ed. (Merck & Co., Inc., Rahway, N.J., 1989), is also an excellent source. For biochemical terminology, including abbreviations and

TABLE 1. Distribution of protein and ATPase in fractions of dialyzed membranes^a

Membranes	Fraction	ATPase	
		U/mg of protein	Total U
Control	Depleted membrane	0.036	2.3
	Concentrated supernatant	0.134	4.82
E1 treated	Depleted membrane	0.034	1.98
	Concentrated supernatant	0.11	4.6

^a Specific activities of ATPase of nondepleted membranes from control and treated bacteria were 0.21 and 0.20, respectively.

symbols, 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 weights 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 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 (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.

The spelling of names should follow the *Approved Lists of Bacterial Names* (amended edition) (V. B. D. Skerman, V. McGowan, and P. H. A. Sneath, ed.) and the *Index of the Bacterial and Yeast Nomenclatural Changes Published in the International Journal of Systematic Bacteriology since the 1980 Approved Lists of Bacterial Names (1 January 1980 to 1 January 1989)* (W. E. C. Moore and L. V. H. Moore, ed.), both published by the American Society for Microbiology in 1989, and the validation lists and articles published in the *International Journal of Systematic Bacteriology* since 1 January 1989. 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 (for an example, see *Int. J. Syst. Bacteriol.* **30**: 547–556, 1980).

It is recommended that a strain be deposited in a recognized culture collection when that strain is necessary for the description of a new taxon (see *Bacteriological Code*, 1990 Revision, American Society for Microbiology, 1992).

Since the classification of fungi is not complete, it is the responsibility of the author to determine the accepted binomial for a given organism. Some sources for these names include *The Yeasts: a Taxonomic Study*, 3rd ed. (N. J. W. Kreger-van Rij, ed., Elsevier Science Publishers B.V., Amsterdam, The Netherlands, 1984), and *Ainsworth and Bisby's Dictionary of the Fungi, Including the Lichens*, 7th ed. (Commonwealth Mycological Institute, Kew, Surrey, England, 1983).

Names used for viruses should be those approved by the International Committee on Taxonomy of Viruses (ICTV) and published in the 4th Report of the ICTV, Classification and Nomenclature of Viruses (*Intervirology* **17**:23–199, 1982), with the modifications contained in the 5th Report of the ICTV (*Arch. Virol.*, Suppl. 2, 1991). If desired, synonyms may be added parenthetically when the name is first mentioned. Approved generic (or group) and family names may also be used.

Microorganisms, viruses, and plasmids should be given designations consisting of letters and serial numbers. It is generally advisable to include a worker's initials 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.

Genetic Nomenclature

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. Use the recommendations of Demerec et al. (*Genetics* **54**:61–76, 1966) as a guide to the use of these terms.

(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, a series of nucleic acid polymerase mutants might be designated Pol1, Pol2, Pol3, etc. Wild-type characteristics can be designated with a superscript plus (Pol⁺), and, when necessary for clarity, negative superscripts

(Pol⁻) can be used to designate mutant characteristics. Lowercase superscript letters may be used to further delineate phenotypes (e.g., Str^s for streptomycin sensitivity). Phenotypic designations should be defined.

(ii) Genotypic designations are similarly indicated by three-letter locus symbols. In contrast to phenotypic designations, these are lowercase italic (e.g., *ara his rps*). If several loci govern related functions, these are distinguished by italicized capital letters following the locus symbol (e.g., *araA araB araC*). Promoter, terminator, and operator sites should be indicated as described by Bachmann and Low (*Microbiol. Rev.* **44**:1–56, 1980), e.g., *lacZp*, *lacAt*, and *lacZo*.

(iii) Wild-type alleles are indicated with a superscript plus (*ara⁺ his⁺*). A superscript minus is not used to indicate a mutant locus; thus, one refers to an *ara* mutant rather than an *ara⁻* strain.

(iv) Mutation sites are designated by placing serial isolation numbers (allele numbers) after the locus symbol (e.g., *araA1 araA2*). If it is not known in which of several related loci the mutation has occurred, a hyphen is used instead of the capital letter (e.g., *ara-23*). It is essential in papers reporting the isolation of new mutants that allele numbers be given to the mutations. For *Escherichia coli*, there is a registry of such numbers: *E. coli* Genetic Stock Center, Department of Biology, Yale University, New Haven, CT 06511-5188. For the genus *Salmonella*, the registry is *Salmonella* Genetic Stock Center, Department of Biology, University of Calgary, Calgary, Alberta T2N 1N4, Canada. For the genus *Bacillus*, the registry is *Bacillus* Genetic Stock Center, Ohio State University, Columbus, OH 43210. A registry of allele numbers and insertion elements (omega [Ω] numbers) for chromosomal mutations and chromosomal insertions of transposons and other insertion elements has been established in conjunction with the ISP collection of *Staphylococcus aureus* at Iowa State University. Blocks of allele numbers and Ω numbers are assigned to laboratories on request. Blocks of numbers and additional information can be obtained from Peter A. Pattee, Department of Microbiology, Iowa State University, Ames, IA 50011. A registry of plasmid designations is maintained by E. Lederberg, Plasmid Reference Center, Department of Medical Microbiology and Immunology, 5402, Stanford University School of Medicine, Stanford, CA 94305-2499.

(v) The use of superscripts with genotypes (other than + to indicate wild-type alleles) should be avoided. Designations indicating amber mutations (Am), temperature-sensitive mutations (Ts), constitutive mutations (Con), cold-sensitive mutations (Cs), production of a hybrid protein (Hyb), and other important phenotypic properties should follow the allele number [e.g., *araA230*(Am) *hisD21*(Ts)]. All other such designations of phenotype must be defined at the first occurrence. If superscripts *must* be used, they must be approved by the editor and they must be defined at the first occurrence.

Subscripts may be used in two situations. Subscripts may be used to distinguish between genes (having the

same name) from different organisms or strains, e.g., *his*_{*E. coli*} or *his*_{K-12} for the *his* genes of *E. coli* or strain K-12 in another species or strain, respectively. An abbreviation may also be used if it is explained. Similarly, a subscript is also used to distinguish between genetic elements that have the same name. For example, the promoters of the *gln* operon can be designated *glnAp*₁ and *glnAp*₂. This form departs slightly from that recommended by Bachmann and Low (e.g., *desC1p*).

(vi) Deletions are indicated by the symbol Δ placed before the deleted gene or region, e.g., Δ *trpA432*, Δ (*aroP-aceE*)419, or Δ *his*(*dhuA hisI hisQ*)1256. Similarly, other symbols can be used (with appropriate definition). Thus, a fusion of the *ara* and *lac* operons can be shown as Φ (*ara-lac*)95. Likewise, Φ (*araB'-lacZ'*)96 indicates that the fusion results in a truncated *araB* gene fused to an intact *lacZ* gene, and Φ (*malE-lacZ*)97(Hyb) shows that a hybrid protein is synthesized. An inversion is shown as IN(*rrnD-rrnE*)1. An insertion of an *E. coli his* gene into plasmid pSC101 at zero kilobases (0 kb) is shown as pSC101 Ω (0kb::K-12*hisB*)4. An alternative designation of an insertion can be used in simple cases, e.g., *galT236*::Tn5. The number 236 refers to the locus of the insertion, and if the strain carries an additional *gal* mutation, it is listed separately. Additional examples, which utilize a slightly different format, can be found in the papers by Campbell et al. and Novick et al. cited below. It is important in reporting the construction of strains 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 a direct or parenthetical remark in the genotype, e.g., (F⁻), Δ Mu *cts*, or *mal*:: Δ Mu *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 above for inserted elements, and an exogenote is shown as, for example, W3110/F'8(*gal*⁺).

Any deviations from standard genetic nomenclature should be explained in Materials and Methods or in a table of strains. For information about the symbols in current use, consult Berlyn et al. (p. 1715–1902, in Neidhardt et al., ed., *Escherichia coli and Salmonella: Cellular and Molecular Biology*, 2nd ed., American Society for Microbiology, Washington, D.C., 1996) for *E. coli* K-12, Sanderson and Roth (Microbiol. Rev. 52:485–532, 1988) for *Salmonella typhimurium*, Holloway et al. (Microbiol. Rev. 43:73–102, 1979) for the genus *Pseudomonas*, Pigot and Hoch (Microbiol. Rev. 49:158–179, 1985) for *Bacillus subtilis*, Perkins et al. (Microbiol. Rev. 46:426–570, 1982) for *Neurospora crassa*, and Mortimer and Schild (Microbiol. Rev. 49:181–213, 1985) for *Saccharomyces cerevisiae*. For yeasts, *Chlamydomonas* spp., and several fungal species, symbols such as those given in the *Handbook of Microbiology* (A. I. Laskin and H. A.

Lechevalier, ed., CRC Press, Inc., Cleveland, Ohio, 1974) should be used.

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 registry of such names in use for *E. coli* is maintained by K. Rudd at the National Center for Biotechnology Information (fax, 301-480-9241; e-mail, rudd@ncbi.nlm.nih.gov) and should be consulted. (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 database includes an updated listing of *E. coli* gene names and gene products. It is accessible on Internet by Gopher (cgsc.biology.yale.edu) or Mosaic/World Wide Web (<http://cgsc.biology.yale.edu/cgsc.html>). The Center's relational database can also be searched via Telnet; for access, send a request to berlyn@cgsc.biology.yale.edu. A list can also be found in the work of Riley (Microbiol. Rev. 57:862–952, 1993). For the genes of other bacteria, consult the references given above.

“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.

Strain designations. Do not use a 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”).

Viruses. The genetic nomenclature for viruses differs from that for bacteria. In most instances, viruses have no phenotype, since they have no metabolism outside host cells. Therefore, distinctions between phenotype and genotype cannot be made. Superscripts are used to indicate hybrid genomes. Genetic symbols may be one, two, or three letters. For example, a mutant strain of λ might be designated λ *Aam11 int2 red114 cI857*; this strain carries mutations in genes *cI*, *int*, and *red* and an amber-suppressible (*am*) mutation in gene *A*. A strain designated λ *att*⁴³⁴ *imm*²¹ would represent a hybrid of phage

λ which carries the immunity region (*imm*) of phage 21 and the attachment (*att*) region of phage 434. Host DNA insertions into viruses 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. Genetic symbols for phage λ can be found in Szybalski and Szybalski (*Gene* 7:217–270, 1979) and in Echols and Murialdo (*Microbiol. Rev.* 42:577–591, 1978).

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 system of designating transposon insertions at sites where there are no known loci, e.g., *zef-123::Tn5*, has been described by Chumley et al. (*Genetics* 91:639–655, 1979). The nomenclature recommendations of Novick et al. (*Bacteriol. Rev.* 40:168–189, 1976) for plasmids and plasmid-specified activities, of Low (*Bacteriol. Rev.* 36:587–607, 1972) for F-prime factors, and of Roberts (*Nucleic Acids Res.* 17:r347–r387, 1989) for restriction enzymes and their isoschizomers should be used when possible. The nomenclature for recombinant DNA molecules constructed in vitro follows the nomenclature for insertions in general. DNA inserted into recombinant DNA molecules should be described by using the gene symbols and conventions for the organism from which the DNA was obtained. The Plasmid Reference Center (E. Lederberg, Plasmid Reference Center, Department of Medical Microbiology and Immunology, 5402, Stanford University School of Medicine, Stanford, CA 94305-2499) assigns Tn and IS numbers to avoid conflicting and repetitive use and also clears nonconflicting plasmid prefix designations.

Tetracycline resistance determinants. The nomenclature for tetracycline resistance determinants is based on the proposal of Levy et al. (*Antimicrob. Agents Chemother.* 33:1373–1374, 1989). The style for such determinants is, e.g., Tet B; the space helps distinguish the determinant designation from that for phenotypes and proteins (TetB). Table 2 of the above-referenced article shows the correct format for genes, proteins, and determinants in this family.

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 Re-

sults 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. 164–166 in *How to Write and Publish a Scientific Paper*, 4th 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 (messenger 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-aminoethyl 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:

amt (amount)	SE (standard error)
approx (approximately)	SEM (standard error of the mean)
avg (average)	
concn (concentration)	sp act (specific activity)
diam (diameter)	sp gr (specific gravity)
expt (experiment)	temp (temperature)
exptl (experimental)	tr (trace)
ht (height)	vol (volume)
mo (month)	vs (versus)
mol wt (molecular weight)	wk (week)
no. (number)	wt (weight)
prepn (preparation)	yr (year)
SD (standard deviation)	

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. Parts per million (ppm) may be used when that is the common measure for the science in that field. Units of temperature are presented as follows: 37°C or 324 K.

When fractions are used to express such units 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 applicable SI units.

Representation of data as accurate to more than two significant figures must be justified by presentation of appropriate statistical analyses.

Statistics

If biological variation within a treatment (coefficient of variation, the standard deviation divided by the mean) is small (less than 10%) and the difference among treatment means is large (greater than 3 standard deviations), it is not necessary to report statistics. If the data do not meet these criteria, however, the authors must include an appropriate statistical analysis (e.g., Student's *t* test, analysis of variance, Tukey's test, etc.). Statistics should represent the variation among biological units (e.g., replicate incubations) and not just the variation due to method of analysis.

Equations

In mathematical equations, indicate the order of operations clearly by enclosing operations in parentheses, brackets, and braces, in that order: $(a + b) \times c$ or $a + (b \times c)$, $100 \times \{(a/b) \times c\} + d$ or $100 \times \{a/[(b \times c) + d]\}$. Italicize (by underlining) variables and constants (but not numerals), and use roman type for designations: E_0 , E_h , M_r , K_m , K_s , $a + 2b = 1.2 \text{ mM}$, $\text{Ca}^{2+}V_{\text{max}} = \exp(1.5x + y)$, $\text{BOD} = 2.7x^2$.

Isotopically Labeled Compounds

For simple molecules, isotopic labeling is indicated in the chemical formula (e.g., ¹⁴CO₂, ³H₂, and H³⁵SO₄). 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 specific chemicals, the symbol for the isotope introduced is placed in 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 C]urea	UDP-[U- ¹⁴ C]glucose
L-[methyl- ¹⁴ C]methionine	<i>E. coli</i> [³² P]DNA
[2,3- ³ H]serine	fructose 1,6-[1- ³² P]bisphosphate
[α- ¹⁴ C]lysine	
[γ- ³² P]ATP	

AEM 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).