AMERICAN SOCIETY FOR MICROBIOLOGY | Applied and Environmental Microbiology®

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INSTRUCTIONS TO AUTHORS

SCOPE

Applied and Environmental Microbiology® (AEM) publishes descriptions of all aspects of applied microbial research, basic research on microbial ecology, and research of a genetic and molecular nature that focuses on microbial topics of practical value. 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, algae, protozoa, and other simple eukaryotic 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. To best serve its readership, the journal must accept only those papers that are most significant to the field of applied and environmental microbiology. Thus, the editors will reject manuscripts that, while scientifically sound, represent only incremental extensions of other studies, are mainly confirmatory, or do not pursue a question in sufficient depth.

AEM publishes minireviews that provide forward-reaching assessments of topics of current relevance to the diverse sections of the journal. Additional information on minireviews can be found in a subsequent part of these Instructions.

AEM welcomes microbiome studies that address the microbiology and functions of natural or experimental systems. The nature of the microbiome study will determine in which section of the journal it will be published.

The **biodegradation** section describes novel microbial processes for alteration, removal, or utilization of environmental or anthropogenic chemicals.

Papers in the **biotechnology** section describe the use and modification of organisms in order to achieve socially beneficial objectives.

The **environmental microbiology** section covers manuscripts that focus on research related to microorganisms in the environment. This is distinct from the microbial ecology section, which focuses on ecological relationships, such as interactions among organisms, their structure and functional role in an ecosystem, and community-level studies. Thus, the environmental microbiology section features articles that focus on specific organisms in the environment, rather than a whole community, as well as those in which the study is not focused on implied or stated underlying ecological relationships.

The **enzymology and protein engineering** section covers a broad range of topics relative to microbial catalysis and includes papers describing (i) the structure and function of environmentally or industrially significant proteins and how they can be modified to achieve practical catalytic objectives and (ii) the enzymology or biosynthesis of fungal, algal, and bacterial metabolites or toxins of importance to the environment or to society.

Included in the **evolutionary and genomic microbiology** section are papers detailing newly described evolutionary processes and evolutionary relationships among microorganisms. Topics include genomic analysis of microorganisms and metagenomic investigation of microbiomes in the environment. (Meta)genome analyses that do not provide significant new insights into the microbiology of the system(s) under study will normally not be acceptable for publication in AEM.

The **food microbiology** section covers manuscripts dealing with all aspects of food microbiology, including microbial food pathogens, microbial ecology of foods, predictive food microbiology, food fermentations, food spoilage, probiotics, and prebiotics. Manuscripts detailing the occurrence of microbial toxins or microbial metabolites are suitable if the work includes significant information on the microbe and its toxin or metabolite production. This section also includes studies on the gastrointestinal tract microbiome as it relates to molecular toxicology, diet, and nutrition. Molecular assessments of food microbiomes should follow guidelines for the microbial ecology section.

The **genetics and molecular biology** section includes papers describing genetic organization, expression, mutation, and repair in organisms with environmental or practical significance.

Manuscripts for the **geomicrobiology** section must emphasize the role of microorganisms in geobiochemical processes in terrestrial or aquatic ecosystems, including subsurface, aquifer, and oceanic environments. Topics include mineralization, the use of inorganic ions in energy metabolism, and growth in extreme environments. Manuscripts focused on geological processes with only marginal links to microbiology will not qualify for AEM.

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 the work concerns a microbial community or individual 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, including the cloning, amplification, and expression of "foreign" genes, to a new genus or species of microbe will generally not be considered for independent publication. Manuscripts that describe the construction of engineered strains for innovative process application, development, or enhancement must present results to authenticate the utility, superiority, and uniqueness of such strains.

The **microbial ecology** section covers a wide range of topics on the ecology of microorganisms, including culture-independent

Instructions to Authors are updated throughout the year. The current version is available on the journal website.

molecular assessments that provide new insights into (i) the structure-function relationships of microorganisms, (ii) the impact of *in situ* conditions on community structure, or (iii) the effect of changes in microbial community composition on ecosystem function. Phylogenetic assessments that do not provide such insights will normally not be acceptable for publication in AEM.

The **physiology** section addresses questions about how organisms adapt to changes in their environment, including bioenergetics, stress, starvation, metabolic challenges, and responses to nutritional variation.

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

The **public and environmental health microbiology** section is focused primarily on environmentally transmitted microorganisms that affect human health. Environmental health microbiology is a branch of public health concerned with the environmental occurrence of disease-causing microbes and with creating health-supportive environments. Microbes of a zoonotic nature or microbes transmitted through water, soil, or environmental surfaces are of special interest.

AEM is not specialized in the systematics of prokaryotes, but taxonomic papers that describe a new prokaryotic taxon are welcome when phylogenetic or genotypic data are accompanied by a significant amount of information that goes beyond the taxonomic description of the new taxon. Such additional information might include information on the novel ecological, physiological, biotechnological, or evolutionary features of the new taxa. Description of a new taxon should include an amount of information adequate to allow the new taxon to be validated and must include genus and species descriptions, which should be placed at the end of the Discussion section. Likewise, the new taxon must be deposited in two publically available culture collections that are in separate countries. Large data sets of comparative phenotypic and genotypic features (e.g., fatty acid compositions, substrate profiles, sequence similarities) or related species that might be of value for the taxonomic evaluation of the new taxon should normally be placed in supplemental material. The section of the journal in which such a paper will be placed will depend on the nature of the new taxon and the environment from which it was isolated.

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 agents as tools for elucidating aspects of applied and environmental microbiology. Other papers dealing with antimicrobial agents, including manuscripts dealing with the biosynthesis and metabolism of such agents, are more appropriate for *Antimicrobial Agents and Chemotherapy*®.

(iii) AEM will consider manuscripts that concern bacteriophages or other viruses in relation to the environment, public health, or industrial microbiology. Papers that primarily concern attachment and intracellular replication of viruses, virus interactions with host metabolism, virus structure, or virus genomics are more appropriate for the *Journal of Virology*®.

(iv) Manuscripts dealing with the immune system or with topics of basic medical interest or oral microbiology are more appropriate for *Infection and Immunity*®. Reports of clinical investigations and environmental biology applied to hospitals should be submitted to the *Journal of Clinical Microbiology*®.

(v) AEM and *mSphere*® accept manuscripts on population dynamics and the ecology of eukaryotic microbes. Studies of microbial communities and of microbial populations with identified economic or ecological significance, e.g., plant pathogens or symbionts, are usually more appropriate for AEM.

(vi) Manuscripts dealing with the purification and characterization of enzymes or cloning of genes that have already been extensively described for other organisms will be considered for publication only if they offer experimentally supported new insights into the biological role, properties, or applications of these enzymes. Descriptions of genes or enzymes that differ only in minor ways from the prototypes are not suitable for AEM.

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.

EDITORIAL POLICY AND ETHICAL GUIDELINES

As a member of the Committee on Publication Ethics (COPE), ASM adheres to COPE's Best Practice Guidelines and expects authors to observe the high standards of publication ethics set out by COPE. ASM requirements for submitted manuscripts are consistent with the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals, as last updated by the International Committee of Medical Journal Editors in December 2014 (http://www.icmje.org/).

Authors are expected to adhere to the highest ethical standards. The following sections of these Instructions include detailed information about ASM's ethical standards. Failure to comply with the policies described in these Instructions may result in a letter of reprimand, a suspension of publishing privileges in ASM journals, and/or notification of the authors' institutions. Authors employed by companies whose policies do not permit them to comply with ASM policies may be sanctioned as individuals and/or ASM may refuse to consider manuscripts having authors from such companies.

Use of Microbiological Information

The Council on Microbial Sciences (COMS) of the American Society for Microbiology affirms the long-standing position of the Society that microbiologists will work for the proper and beneficent application of science and will call to the attention of the public or the appropriate authorities misuses of microbiology or of information derived from microbiology. ASM members are obligated to discourage any use of microbiology contrary to the welfare of humankind, including the use of microbes as biological weapons. Bioterrorism violates the fundamental principles expressed in the Code of Ethics of the Society and is abhorrent to ASM and its members.

ASM recognizes that there are valid concerns regarding the publication of information in scientific journals that could be put to inappropriate use as described in the COMS resolution mentioned above. Members of the ASM Journals Board will evaluate the rare manuscript that might raise such issues during the review process. However, as indicated elsewhere in these Instructions, primary-research articles must contain sufficient detail, and material/information must be made available, to permit the work to be repeated by others. Supply of materials should be in accordance with laws and regulations governing the shipment, transfer, possession, and use of biological materials and must be for legitimate, bona fide research needs. We ask that authors pay particular attention to the NSAR Select Agent/Toxin list on the CDC website https://www.selectagents.gov/index.html and the U.S. Government Policy for Oversight of Life Sciences Dual Use Research of Concern (March 2012; http://www.phe.gov/s3/dualuse/Documents/us-policy-durc-032812.pdf).

Use of Human Subjects or Animals in Research

Authors of manuscripts describing research involving human subjects or animal experimentation must obtain review and approval (or review and waiver) from their Institutional Review Board (IRB) or Institutional Animal Care and Use Committee (IACUC), as appropriate, prior to manuscript submission. Authors of manuscripts that describe multisite research must obtain approval from each institution's IRB or IACUC, as appropriate. Documentation of IRB or IACUC status must be made available upon request. In the event that institutional review boards or committees do not exist, the authors must ensure that their research is carried out in accordance with the Declaration of Helsinki, as revised in 2013 (https://jamanetwork.com/journals/jama/fullarticle/1760318), and/or the "International Guiding Principles for Biomedical Research Involving Animals," as revised by the International Council for Laboratory Animal Science (ICLAS) and the Councils for International Organizations of Medical Sciences (CIOMS) in 2012. A statement of IRB or IACUC approval or waiver (and reason for waiver) or a statement of adherence to the Declaration of Helsinki and/or Guiding Principles must be included in the Materials and Methods section. The sex of research subjects and animals, and of materials derived directly from them (e.g., primary cell lines and clinical samples), should be included in the Materials and Methods section or Results section if these data are available.

Publishing Ethics

Authorship. ASM journals follow the criteria for authorship as outlined in the International Committee of Medical Journal Editors (ICMJE) Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals ("Defining the Role of Authors and Contributors"). Briefly, an author is one who makes a substantial contribution to the design, execution, and/or analysis and interpretation of experiments in addition to drafting, revising, and/or approving the initial submission and any subsequent versions of the article. All authors of a manuscript must have agreed to its submission and are responsible for appropriate portions of its content. Submission of a paper before all coauthors have read and approved it is considered an ethical violation.

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Corresponding author. The corresponding author takes primary responsibility for communicating with the journal and coauthors throughout the submission, peer review, and publication processes. The corresponding author is responsible for ensuring that all coauthors have read and approved submissions, including appropriate citations, acknowledgments, and byline order. Additionally, the corresponding author and the study's primary investigator(s), if different, are required to have examined the raw data represented in the manuscript, affirm that such representations accurately reflect the original data, and ensure that the original data are preserved and retrievable.

Consortium authorship. A study group, surveillance team, working group, consortium, or the like (e.g., the Active Bacterial Core Surveillance Team) may be listed as a coauthor in the byline if its contributing members satisfy the requirements for authorship and accountability as described in these Instructions. The names (and institutional affiliations, if desired) of the contributing members only may be given as a separate paragraph in the Acknowledgments section. If the contributing members of the group associated with the work do not fulfill the criteria of substantial contribution to and responsibility for the paper, the group may not be listed in the author byline. Instead, it and the names of its contributing members may be listed in the Acknowledgments section.

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Plagiarism is not limited to the text; it can involve any part of the manuscript, including figures and tables, in which material is copied from another publication without permission and attribution. An author may not reuse his or her own previously published work without attribution; this is considered text recycling (also known as self-plagiarism).

ASM has incorporated plagiarism detection software into its online submission and peer review system in order to help editors verify the originality of submitted manuscripts. Selected manuscripts are scanned and compared with databases. If plagiarism is detected, COPE guidelines on plagiarism will be followed.

Image manipulation. Submitted figures must reflect original data. Please refer to the "Image manipulation" section in Illustrations and Tables for an overview of permissible manipulations, unacceptable adjustments, and required information to be disclosed in the figure legends of images.

ASM applies forensic imaging tools to screen selected manuscripts for inappropriate manipulation of figures. If unacknowledged and/or inappropriate image manipulations are detected, the matter will be referred to the journal's ethics panel for consideration.

Fabrication, manipulation, and falsification of data. As a member of the Committee on Publication Ethics (COPE), ASM encourages authors to consult COPE's "Code of Conduct and Best Practice Guidelines for Journal Editors" (https://publicationethics.org/files/Code_of_conduct_for_journal_editors_0.pdf). Fabrication, manipulation, and falsification of data constitute misconduct. As defined by the U.S. Department of Health and Human Services, fabrication is "making up data or results and recording or reporting them" and falsification is "manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record" (42 Code of Federal Regulations, §93.103). All sources and methods used to obtain and analyze data, including any electronic preprocessing, should be fully disclosed; detailed explanations should be provided for any exclusions.

Primary publication. 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. By submitting 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.** It is incumbent upon the author to acknowledge any prior publication, including his/her own articles, of the data contained in a manuscript submitted to an ASM journal. A copy of the relevant work should be submitted with the paper as supplemental material not for publication. Whether the material constitutes the substance of a paper and therefore renders the manuscript unacceptable for publication is an editorial decision.

In the event that the authors' previously published figures and/or data are included in a submitted manuscript, it is incumbent upon the corresponding author to (i) identify the duplicated material and acknowledge the source on the submission form, (ii) obtain permission from the original publisher (i.e., copyright owner), (iii) acknowledge the duplication in the figure legend, and (iv) cite the original article.

A paper is not acceptable for submission to an ASM journal if it, or its substance, has been made publicly available in the following:

- A serial, periodical, or book
- A conference report or symposium proceedings

- A technical bulletin or company white paper
- A public website (see "Preprint policy")
- Any other retrievable source

The following do not preclude submission to, or publication by, an ASM journal:

- Posting of a method/protocol on a public website
- Posting of a limited amount of original data on a personal/university/corporate website or websites of small collaborative groups working on a problem
- Deposition of unpublished sequence data in a public database
- Preliminary disclosures of research findings as meeting posters, webcast as meeting presentations, or published in abstract form as adjuncts to a meeting, e.g., part of a program
- Posting of theses and dissertations on a personal/university-hosted website

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First-time claims. First-time claims should be avoided. As explained in the first paragraph of the Scope section, manuscripts should report new and significant findings that advance the understanding of microbiology; therefore, first-time claims are unnecessary.

Conflict of Interest

All authors are expected to disclose, in the manuscript submittal letter, any commercial affiliations as well as consultancies, stock or equity interests, and patent-licensing arrangements that could be considered to pose a conflict of interest regarding the submitted manuscript. (Inclusion of a company name in the author address lines of the manuscript does not constitute disclosure.) Details of the disclosure to the editor will remain confidential. However, it is the responsibility of authors to provide, in the Acknowledgments section, a general statement disclosing conflicting interests relevant to the study. Examples of potentially conflicting interests include relationships, financial or otherwise, that might detract from an author's objectivity in presentation of study results and interests whose value would be enhanced by the results presented. All funding sources for the project, institutional and corporate, should be credited in the Acknowledgments section, as described below. In addition, if a manuscript concerns a commercial product, the manufacturer's name must be indicated in the Materials and Methods section or elsewhere in the text, as appropriate, in an obvious manner.

Data and Materials

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Data citation. To promote reproducibility, ASM expects researchers to identify and cite data sets and/or code used in their experiments and studies. These may be large or complex data sets that can include, but are not limited to, data from microarray, genomic, structural, proteomic, or video imaging analyses. **Authors should cite both the data set repository and the published article in which the data set and/or code was originally described.** Citations of data should be included in the reference list with persistent unique identifiers (e.g., active URLs, accession numbers, etc.). If computer code or software was created to generate results or interpret data, then a statement to that effect should be included in the "Data availability" paragraph. For cases in which the software is publicly available (e.g., FigTree to generate phylogenetic trees), the URL of the software informational page should be provided. **It is preferred that authors use established, publicly available data type-specific repositories.** If there is no appropriate repository available, general publicly available repositories should be used (e.g., Dryad, figshare, etc.). Examples of proper data citation are included in the "References" section of these Instructions to Authors.

Culture deposition. AEM expects 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 sources as well as original culture collection identification numbers.

Authentication of cell lines. Cell line misidentification or contamination can adversely impact the validity of research findings. Authors should describe the source along with the date and method used for authentication of any cell lines used in manuscripts submitted to this journal. Cell lines used less than 6 months after receipt from a cell bank that performs

authentication do not require reauthentication, but the source and method of authentication should be reported in the Materials and Methods section.

Nucleotide and amino acid sequences. Newly determined nucleotide and/or amino acid sequence data must be deposited and GenBank/ENA/DDBJ accession numbers must be included in the manuscript no later than the modification stage of the review process. It is expected that the sequence data will be released to the public no later than the publication (online posting) date of the accepted manuscript. Authors are encouraged to comply with community metadata standards, such as the "Minimal Information about any (X) Sequence" (MIxS) checklist (http://gensc.org/projects/mixs-gsc-project/), when submitting to GenBank, ENA, or DDBJ. The accession numbers should be included in a separate paragraph with the lead-in "Accession number(s)" at the end of the Materials and Methods section. If conclusions in a manuscript are based on the analysis of sequences and a GenBank/ENA/DDBJ accession number is not provided at the time of the review, authors should provide the annotated sequence data as supplemental material not for publication.

It is expected that, when previously published sequence accession numbers are cited in a manuscript, the original published article(s), as well as a citation of the database where the accession number is deposited, will be included in the References section.

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.

Analyses should specify the database, and the date of each analysis should be indicated as, e.g., 6 January 2018. If relevant, the version of the software used should be specified.

See "Presentation of Nucleic Acid Sequences" for nucleic acid sequence formatting instructions.

The URLs of the databases mentioned above are as follows: DNA Data Bank of Japan (DDBJ), http://www.ddbj.nig.ac.jp/; European Nucleotide Archive (ENA), https://www.ebi.ac.uk/ena/; and GenBank, National Center for Biotechnology Information, https://www.ncbi.nlm.nih.gov/nucleotide.

Proper use of locus tags as systematic identifiers for genes. To comply with recommendations from the International Nucleotide Sequence Database (INSD) Collaborators and to avoid conflicts in gene identification, researchers should implement the following two fundamental guidelines as standards for utilization of locus tags in genome analysis, annotation, submission, reporting, and publication. (i) Locus tag prefixes are systematic gene identifiers for all of the replicons of a genome and as such should be associated with a single genome project submission. (ii) New genome projects must be registered with the INSD, and new locus tag prefixes must be assigned in cooperation with the INSD to ensure that they conform to the agreed-upon criteria.

Structural determinations. Coordinates for new structures of macromolecules determined by X-ray crystallography or cryo-electron microscopy must be deposited in the Protein Data Bank and assigned identification codes must be included in the manuscript no later than the modification stage of the review process. It is expected that the coordinates will be released to the public no later than the publication (online posting) date of the accepted manuscript. Authors are encouraged to send coordinates with their original submission, however, so that reviewers can examine them along with the manuscript. The accession number(s) should be listed in a separate paragraph with the lead-in "Accession number(s)" at the end of the Materials and Methods section.

The URLs for coordinate deposition are https://deposit-1.wwpdb.org/deposition/ and http://www.rcsb.org/pdb/home/home.do#Category-deposit.

Gene expression data. The entire set of supporting microarray, next-generation sequencing, or other high-throughput functional genomics data must be deposited in the appropriate public database (e.g., GEO, ArrayExpress, or CIBEX) and the assigned accession number(s) must be included in the manuscript no later than the modification stage of the review process. It is expected that the data will be released to the public no later than the publication (online posting) date of the accepted manuscript. Authors are encouraged to send the relevant data with their original submission, however, so that reviewers can examine them along with the manuscript. The accession number(s) should be listed in a separate paragraph with the lead-in "Accession number(s)" at the end of the Materials and Methods section.

The URLs of the databases mentioned above are as follows: Gene Expression Omnibus (GEO), https://www.ncbi.nlm.nih.gov/geo/; ArrayExpress, https://www.ebi.ac.uk/arrayexpress/; and Center for Information Biology Gene Expression Database (CIBEX), http://cibex.nig.ac.jp/data/index.html.

MycoBank. New scientific names of fungi along with key nomenclatural and descriptive material must be deposited in MycoBank (http://www.mycobank.org/) and the assigned accession number(s) must be included in the manuscript no later than the modification stage of the review process. It is expected that the data will be released to the public no later than the publication (online posting) date of the accepted manuscript. Authors are encouraged to send the relevant data with their original submission, however, so that reviewers can examine them along with the manuscript. The accession number(s) should be listed in a separate paragraph with the lead-in "Accession number(s)" at the end of the Materials and Methods section.

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11. Smith D, Johnson C, Maier M, Maurer JJ. 2005. Distribution of fimbrial, phage and plasmid associated virulence genes among poultry *Salmonella enterica* serovars, abstr P-038, p 445. Abstr 105th Gen Meet Am Soc Microbiol. American Society for Microbiology, Washington, DC. {*Abstract title is optional.*}
12. García CO, Paira S, Burgos R, Molina J, Molina JF, Calvo C, Vega L, Jara LJ, García-Kutzbach A, Cuellar ML, Espinoza LR. 1996. Detection of *Salmonella* DNA in synovial membrane and synovial fluid from Latin American patients using the polymerase chain reaction. Arthritis Rheum 39(Suppl 9):S185. {*Meeting abstract published in journal supplement.*}
13. O'Malley DR. 1998. PhD thesis. University of California, Los Angeles, CA. {*Title is optional.*}
14. Stratagene. 2006. Yeast DNA isolation system: instruction manual. Stratagene, La Jolla, CA. {*Use the company name as the author if none is provided for a company publication.*}
15. Odell JC. April 1970. Process for batch culturing. US patent 484,363,770. {*Include the name of the patented item/process if possible; the patent number is mandatory.*}
16. Harrison F, Roberts AEL, Gabrilska R, Rumbaugh KP, Lee C, Diggle SP. 2015. A 1,000-year-old antimicrobial remedy with antistaphylococcal activity. mBio 6:e01129-15. {*Original article that describes how data submitted to a database were generated.*}
17. Harrison F, Roberts AEL, Gabrilska R, Rumbaugh KP, Lee C, Diggle SP. 2015. Data from "A 1,000-year-old antimicrobial remedy with antistaphylococcal activity." Dryad Digital Repository https://doi.org/10.5061/dryad.mn17p. {*Citation for the database where the data in the previous reference were deposited; the URL is necessary.*}
18. Wang Y, Rozen D. 2016. Colonization and transmission of the gut microbiota of the burying beetle, *Nicrophorus vespilloides*, through development. bioRxiv https://doi.org/10.1101/091702.

*A reference to an in-press ASM publication should state the control number (e.g., AEM00123-18) if it is a journal article or the name of the publication if it is a book.

In some online journal articles, posting or revision dates may serve as the year of publication; a DOI (preferred) or URL is required for articles with nontraditional page numbers or electronic article identifiers.

> Magalon A, Mendel RR. 15 June 2015, posting date. Biosynthesis and insertion of the molybdenum cofactor. EcoSal Plus 2015 doi:10.1128/ecosalplus.ESP-0006-2013.

Note: a posting or accession date is required for any online reference that is periodically updated or changed.

Citations of ASM Accepts manuscripts should look like the following example.

> Wang GG, Pasillas MP, Kamps MP. 15 May 2006. Persistent transactivation by Meis1 replaces Hox function in myeloid leukemogenesis models: evidence for co-occupancy of Meis1-Pbx and Hox-Pbx complexes on promoters of leukemia-associated genes. Mol Cell Biol doi:10.1128/MCB.00586-06.

Other journals may use different styles for their publish-ahead-of-print manuscripts, but citation entries must include the following information: author name(s), posting date, title, journal title, and volume and page numbers and/or DOI. The following is an example:

Zhou FX, Merianos HJ, Brunger AT, Engelman DM. 13 February 2001. Polar residues drive association of polyleucine transmembrane helices. Proc Natl Acad Sci U S A doi:10.1073/pnas.041593698.

To encourage data sharing and reuse, ASM recommends reporting data sets and/or code both in a dedicated "Data availability" paragraph and in References. The components of a complete data citation include the following:

- Responsible party (senior author, collector, agency),
- Publication year,
- Complete name of a data set, including the name of the database or repository and its URL, **or** the name of the analysis software (if appropriate), including the version and project,
- Publisher (if appropriate), and
- Persistent unique identifier(s) (e.g., URL[s] or accession number[s]).

The following templates may be helpful.

Author. Year. Description of study topic. Retrieved from Database URL (accession no. ●●●●●●). {*Unpublished raw data.*}

Author. Year. Description or title of software (version). Repository URL. Retrieved day month year. {*Software or code.*}

Examples follow.

Christian SL, McDonough J, Liu C-Y, Shaikh S, Vlamakis V, Badner JA, Chakravarti A, Gershon ES. 2002. Data from "An evaluation of the assembly of an approximately 15-Mb region on human chromosome 13q32-q33 linked to bipolar disorder and schizophrenia." GenBank https://www.ncbi.nlm.nih.gov/nuccore/AF339794 (accession no. AF339794). {*Accession number.*}

Sun Z. 2013. Reprocessed: in-depth membrane proteomic study of breast cancer tissues. ProteomeXchange http://proteomecentral.proteomexchange.org/cgi/GetDataset?ID=RPXD000665 (accession number requested). {*Unassigned accession number.*}

Hogle S. 2015. Supplemental material for Hogle et al. 2015 mBio. figshare https://doi.org/10.6084/m9.figshare.1533034.v1. Retrieved 16 March 2017. {*Code and/or software.*}

Nesbitt HK, Moore JW. 2016. Data from "Species and population diversity in Pacific salmon fisheries underpin indigenous food security." Dryad Digital Repository https://doi.org/10.5061/dryad.ng8pf. {*Data set in repository.*}

Manuscript submissions that have appeared in preprint archives should cite the preprint in References, and the fact that a paper has appeared online before should be mentioned parenthetically at the end of the introductory section: (This article was submitted to an online preprint archive [1].) The reference should take the form noted above in reference 18.

(ii) References cited in the text. References that should be cited in the text include the following:

- Unpublished data
- Manuscripts submitted for publication
- Unpublished conference presentations (e.g., a report or poster that has not appeared in published conference proceedings)
- Personal communications
- Patent applications and patents pending
- Websites

These references should be made parenthetically in the text as follows:

. . . similar results (R. B. Layton and C. C. Weathers, unpublished data).
. . . system was used (J. L. McInerney, A. F. Holden, and P. N. Brighton, submitted for publication).
. . . as described previously (M. G. Gordon and F. L. Rattner, presented at the Fourth Symposium on Food Microbiology, Overton, IL, 13 to 15 June 1989). {*For nonpublished abstracts and posters, etc.*}
. . . this new process (V. R. Smoll, 20 June 1999, Australian Patent Office). {*For non-U.S. patent applications, give the date of publication of the application.*}
. . . as suggested by the World Health Organization (http://www.who.int/campaigns/immunization-week/2017/en/).

URLs for companies that produce any of the products mentioned in your study or for products being sold may not be included in the article. However, company URLs that permit access to scientific data related to the study or to shareware used in the study are permitted.

(iii) Citations in abstracts. Because the abstract must be able to stand apart from the article, references cited in it should be clear without recourse to the References section. Use an abbreviated form of citation, omitting the article title, as follows.

(P. S. Satheshkumar, A. S. Weisberg, and B. Moss, J Virol 87:10700–10709, 2013, doi:10.1128/JVI.01258-13)
(J. H. Coggin, Jr., p. 93–114, *in* D. O. Fleming and D. L. Hunt, ed., *Biological Safety. Principles and Practices*, 4th ed., 2006)
". . . in a recent report by D. A. Hopwood (mBio 4: e00612-13, 2013, doi:10.1128/mBio00612-13) . . . ."

This style should also be used for Addenda in Proof.

(iv) References related to supplemental material. If references must be cited in the supplemental material, list them in a **separate** References section within the supplemental material and cite them by those numbers; do not simply include citations of numbers from the reference list of the associated article. If the same reference(s) is to be cited in both the article itself and the supplemental material, then that reference would be listed in both References sections.

Short-Form Papers

AEM no longer considers papers in the short-form format. New submissions must be formatted as full-length Research Articles.

Minireviews

Minireviews are brief (**limit of 6,000 words 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 AEM.

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 the eJP online manuscript submission and peer review system. The cover letter should state whether the article was solicited and by whom.

Minireviews must have abstracts. Limit the abstract to 250 words or fewer. The body of the Minireview may have section headings and/or paragraph lead-ins.

Author bios. At the editor's invitation, corresponding authors of minireviews may submit a short biographical sketch and photo for each author for publication with the article. Biographical information should be submitted at the modification stage.

- The text limit is 150 words for each author and should include WHO you are (your name), WHERE you received your education, WHAT positions you have held and at WHICH institutions, WHERE you are now (your current institution), WHY you have this interest, and HOW LONG you have been in this field.
- The photo should be a black-and-white head shot of passport size. Photos will be reduced to approximately 1.125 inches wide by 1.375 inches high. Photos must meet the production criteria for regular figures and should be checked for production quality by using Rapid Inspector, provided at the following URL: http://rapidinspector.cadmus.com/RapidInspector/zmw/index.jsp.
- To submit, upload the text and photos with your modified manuscript in the eJP online manuscript submission and peer review system. Include the biographical text after the References section of your manuscript, in the same file. Upload the head shots in the submission system as a "Minireview Bio Photo"; **include the author's name or enough of it for identification in each photo's file name.**

Contact the scientific editor if you have questions about what to write. Contact the production editor if you have questions about submitting your files.

Meeting Reviews

Meeting Reviews are brief summaries of recent scientific meetings that cover topics within the scope of AEM. Reviews should be timely and focus on major themes, new developments, emerging trends, and significant unanswered questions presented and discussed at the meeting. Sufficient background should be provided to make the report useful to the general reader. The author must provide written assurance from the relevant individuals that permission to cite their presented material has been granted.

Meeting Reviews, which may be solicited or proffered by authors, are subject to editorial review and should be submitted via the eJP online manuscript submission and peer review system. They should not exceed 5,000 words, exclusive of references.

Commentaries

Commentaries are invited communications concerning topics relevant to the readership of AEM and are intended to engender discussion. Reviews of the literature, methods and other how-to papers, and responses targeted at a specific published paper are not appropriate. Commentaries are subject to review.

The length may not exceed 3,000 words, exclusive of references, and the format is like that of a Minireview (see above) except that the abstract is limited to 75 words.

Letters to the Editor

Letters to the Editor are intended only for comments on final, typeset articles published in the journal (not on accepted manuscripts posted online) and must cite published references to support the writer's argument.

Letters may be **no more than 500 words long, exclusive of references, and must be typed double-spaced**. Refer to a recently published Letter for correct formatting. Note that authors and affiliations are listed below the title.

All Letters to the Editor must be submitted electronically, and the manuscript type (Comment Letter) must be selected from the choices in the submission form. The cover letter should state the volume and issue in which the article commented on was published, the title of the article, and the last name of the first author. In the Abstract section of the submission form, put "Not Applicable." Letters to the Editor do not have abstracts. The Letter must have a title, which must appear on the manuscript and on the submission form. Figures and tables should be kept to a minimum.

The Letter will be sent to the editor who handled the article in question. The letter may be sent for peer review. If the editor believes that publication is warranted, he/she 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.

Please note that some indexing/abstracting services do not include Letters to the Editor in their databases.

Errata

Errata provide a means of correcting errors that occurred during the writing, typing, editing, or publication (e.g., a misspelling, a dropped word or line, or mislabeling in a figure) of a published article. Submit Errata via the eJP online manuscript submission and peer review system (see "Submission, Review, and Publication Processes"). In the Abstract section of the submission form (a required field), put "Not Applicable." Upload the text of your Erratum as a Microsoft Word file. Please see a recent issue for correct formatting.

Author Corrections

Author Corrections provide 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 (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 [noncritical] portion of the study). Note that the addition of new data is not permitted.

For corrections of a scientific nature or issues involving authorship, including contributions and use or ownership of data and/or materials, all disputing parties must agree, in writing, to publication of the Correction. For omission of an author's name, letters must be signed by the authors of the article and the author whose name was omitted. The editor who handled the article will be consulted if necessary.

Submit an Author Correction via the eJP online manuscript submission and peer review system (see "Submission, Review, and Publication Processes"). Select Author Correction as the manuscript type. In the Abstract section of the submission form (a required field), put "Not Applicable." Upload the text of your Author Correction as a Microsoft Word file. Please see a recent issue for correct formatting. Signed letters of agreement must be supplied as supplemental material not for publication (scanned PDF files).

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. Submit Retractions via the eJP online manuscript submission and peer review system (see "Submission, Review, and Publication Processes"). In the Abstract section of the submission form (a required field), put "Not Applicable." Upload the text of your Retraction as a Microsoft Word file. Letters of agreement signed by all of the authors must be supplied as supplemental material not for publication (scanned PDF files). The Retraction will be assigned to the editor in chief of the journal, and the editor who handled the paper and the chairperson of the ASM Journals 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.

CrossMark

ASM has implemented CrossMark. CrossMark is a multipublisher initiative to provide a standard way for readers to locate the current version of an article. Clicking on the CrossMark logo will indicate whether an article is current or whether updates have been published. Additional information about CrossMark can be found on CrossMark's website and on ASM's CrossMark policy page.

ILLUSTRATIONS AND TABLES

Illustrations

Image manipulation. Digital images submitted for publication may be inspected by ASM production specialists for any manipulations or electronic enhancements that may be considered to be the result of scientific misconduct based on the guidelines provided below. Any images/data found to contain manipulations of concern will be referred to the editor in chief, and authors may then be requested to provide their primary data for comparison with the submitted image file. Investigation of the concerns may delay publication and may result in revocation of acceptance and/or additional action by ASM.

Linear adjustments to contrast, brightness, and/or color are generally acceptable, as long as the measures taken are necessary to view elements that are already present in the data and the adjustments are applied to the entire image and not just specific areas. Unacceptable adjustments to images include, but are not limited to, the removal or deletion, concealment, duplication (copying and pasting), addition, selective enhancement, or repositioning of elements within the image.

Nonlinear adjustments made to images, such as changes to gamma settings, should be fully disclosed in the figure legends at the time of submission. In addition, images created by compiling multiple files, including noncontiguous portions of the same image, should clearly convey that these multiple files are not a single image. This can be done by "tooling," or inserting thin lines, between the individual images.

File types and formats. Illustrations may be continuous-tone images, line drawings, or composites. Color graphics may be submitted. Suggestions about how to ensure accurate color reproduction are given below.

On initial submission, figures may be uploaded as individual PDF files or combined and uploaded as a single PDF file. Place each legend in the text file, as well as on the same page with the corresponding figure to assist review. At the modification stage, production-quality digital files must be provided. Because the legends will be copyedited and typeset for final publication, they should appear within the main text, after the References section, and should not be included as part of the figure itself at this stage. All graphics submitted with modified manuscripts must be bitmap, grayscale, or in the RGB (preferred) or CMYK color mode. See "Color illustrations." Halftone images (those with various densities or shades) must be grayscale, not bitmap. AEM accepts TIFF or EPS files but discourages the use of PowerPoint for either black-and-white or color images.

For instructions on creating acceptable EPS and TIFF files,

refer to the Cadmus digital art website, http://art.cadmus.com/da/index.jsp. PowerPoint requires users to pay close attention to the fonts used in their images (see the section on fonts below). If instructions for fonts are not followed exactly, images prepared for publication are subject to missing characters, improperly converted characters, or shifting/obscuring of elements or text in the figure. For proper font use in PowerPoint images, refer to the Cadmus digital art website, http://art.cadmus.com/da/instructions/ppt_disclaimer.jsp. Note that, due to page composition system requirements, you must verify that your PowerPoint files can be converted to PDF without any errors.

We strongly recommend that before returning their modified manuscripts, 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/RapidInspector/zmw/index.jsp. Rapid Inspector is an easy-to-use, Web-based application that identifies file characteristics that may render the image unusable for production. Please note when using Rapid Inspector to check PowerPoint files that there is a known bug in the application that can occasionally fail PowerPoint Presentation (.pptx) files, even though the files meet all required production criteria. If you experience this bug, the issue can be corrected by saving the PowerPoint files as an older version, PowerPoint 97-2004 Presentation (.ppt), during the Save As process (use the drop-down format menu and select this format). Once you save your files as .ppt, they will pass Rapid Inspector if all required production criteria have been met.

If you have additional questions about using the Rapid Inspector preflighting tool, please send an e-mail inquiry to helpdesk.digitalartsupport@cenveo.com.

Minimum resolution. It is extremely important that a high enough resolution is used. All separate images that you import into a figure file must be at the correct resolution before they are placed. (For instance, placing a 72-dpi image in a 300-dpi EPS file will not result in the placed image meeting the minimum requirements for file resolution.) Note, however, that the higher the resolution, the larger the file and the longer the upload time. Publication quality will not be improved by using a resolution higher than the minimum. Minimum resolutions are as follows:

- 300 dpi for grayscale and color
- 600 dpi for combination art (lettering and images)
- 1,200 dpi for line art

Size. All graphics **should 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. Resolution must be at the required level at the submitted size. 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 figure width: 6.875 inches (ca. 17.4 cm)
- Maximum figure height: 9.0625 inches (23.0 cm)

Contrast. Illustrations must contain sufficient contrast to be viewed easily on a monitor or on the printed page.

Labeling and assembly. All final lettering and labeling must be incorporated into the figures. On initial submission, illustrations should be provided as PDF files, with the legends in the text file and with a legend beneath each image to assist review. At the modification stage, production-quality digital figure files (without legends) must be provided. Put the figure number well outside the boundaries of the image itself. (Numbering may need to be changed at the copyediting stage.) Each figure must be uploaded as a separate file, and any multipanel figures must be assembled into one file; i.e., rather than uploading 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 fonts: Arial, Helvetica, Times Roman, European PI, Mathematical PI, or Symbol. Courier may be used but should be limited to nucleotide or amino acid sequences, where a nonproportional (monospace) font is required. All fonts other than these must be converted to paths (or outlines) in the application with which they were created.

Color illustrations. All figures submitted in color will be processed as color. Adherence to the following guidelines will help to ensure color reproduction that is as accurate as possible.

The final online version is considered the version of record for AEM and all other ASM journals. To maximize online reproduction, color illustrations should be supplied in the RGB color mode as either (i) RGB TIFF images with a resolution of at least 300 pixels per inch (raster files, consisting of pixels) or (ii) Illustrator-compatible EPS files with RGB color elements (vector files, consisting of lines, fonts, fills, and images). CMYK files are also accepted. Other than in color space, CMYK files must meet the same production criteria as RGB files. The RGB color space is the native color space of computer monitors and of most of the equipment and software used to capture scientific data, and it can display a wider range of colors (especially bright fluorescent hues) than the CMYK (cyan, magenta, yellow, black) color space used by print devices that put ink (or toner) on paper. For reprints, ASM's print provider will automatically create CMYK versions of color illustrations from the supplied RGB versions. Color in the reprints may not match that in the online journal of record because of the smaller range of colors capable of being reproduced by CMYK inks on a printing press. For additional information on RGB versus CMYK color, refer to the Cadmus digital art site, http://art.cadmus.com/da/guidelines_rgb.jsp.

Drawings

Submit graphs, charts, complicated chemical or mathematical formulas, diagrams, and other drawings as finished products not requiring additional artwork or typesetting. All elements, including letters, numbers, and symbols, must be easily readable, and both axes of a graph must be labeled.

When creating line art, please use the following guidelines:

(i) **All art must be submitted at its intended publication size.** For acceptable dimensions, see "Size" above.

(ii) **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 patterns are not imported from another application. If you must use images containing screens,

(a) Generate the image at line screens of 85 lines per inch or less.

(b) When applying multiple shades of gray, differentiate the gray levels by at least 20%.

(c) Never use levels of gray below 5% or above 95% as they are likely to fade out or become totally black when output.

(iii) Use thick, solid lines that are no finer than 1 point in thickness.

(iv) Use type that is no smaller than 6 points at the final publication size.

(v) Avoid layering type directly over shaded or textured areas.

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

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

(viii) 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 Système International d'Unités (SI) symbols (μ for 10^{-6}, m for 10^{-3}, k for 10^{3}, and M for 10^{6}, etc.). Thus, representation of 20,000 cpm on a figure ordinate should be made by the number 20 accompanied by the label kcpm. A complete listing of SI symbols can be found in the International Union of Pure and Applied Chemistry (IUPAC) publication *Quantities, Units and Symbols in Physical Chemistry*, 3rd ed. (RSC Publishing, Cambridge, United Kingdom, 2007), and at https://www.nist.gov/physical-measurement-laboratory/special-publication-811.

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 should be "2" and the label should be "10^{4} cells per ml" (not "cells per ml $\times$ 10^{-4}"). Likewise, an enzyme activity of 0.06 U/ml might be shown as 6 accompanied by the label 10^{-2} U/ml. The preferred designation is 60 mU/ml (milliunits per milliliter).

Presentation of Nucleic Acid Sequences

Long 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 (ca. 15.2 cm). If possible, lines of nucleic acid sequence should be further subdivided into blocks of 10 or 20 nucleotides by spaces within the sequence or by marks above it. Uppercase and lowercase letters may be used to designate the exon-intron structure or transcribed regions, etc., if the lowercase letters remain legible at a 6-inch (ca. 15.2-cm) line length. 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, and 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 closely as possible to the same format.

Figure Legends

On initial submission, each legend should be placed in the text file *and* be incorporated into the image file beneath the figure to assist review.

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 complex shading must be submitted as illustrations in an acceptable format at the modification stage. The preferred format for regular tables is Microsoft Word; however, WordPerfect and Acrobat PDF are also acceptable. Note that a straight Excel file is not currently an acceptable format. Excel files must be either embedded in a Word or WordPerfect document or converted to PDF before being uploaded.

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 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.

Cover Photographs and Drawings

AEM publishes photographs and drawings on the front cover. Invitations to submit an illustration for consideration as cover art are issued to authors whose manuscripts are returned for modification or whose manuscripts have been accepted for publication in AEM; material should be related to the work

TABLE 1 Distribution of protein and ATPase in fractions of dialyzed membranes[a]

Membrane	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.

presented in the AEM manuscript. Unsolicited photos will also be considered. No material submitted for consideration will be returned to the author. Authors will be notified only if their cover art is selected. 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. Technical specifications for submission and comments on potential illustrations can be obtained from the cover editor, Andrew J. McBain (andrew.mcbain@manchester.ac.uk).

NOMENCLATURE

Chemical and Biochemical Nomenclature

The recognized authority for the names of chemical compounds is *Chemical Abstracts* (CAS; http://www.cas.org/) and its indexes. *The Merck Index Online* (https://www.rsc.org/merck-index) is also an excellent source. For biochemical terminology, including abbreviations and symbols, consult *Biochemical Nomenclature and Related Documents* (Portland Press, London, United Kingdom, 1992), available at http://www.sbcs.qmul.ac.uk/iupac/bibliog/white.html, and the Instructions to Authors of the *Journal of Biological Chemistry* and the *Archives of Biochemistry and Biophysics*.

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, NY, 1992) and its supplements and at http://www.sbcs.qmul.ac.uk/iubmb/enzyme/. 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. Authors of papers describing enzymological studies should review the standards of the STRENDA Commission for information required for adequate description of experimental conditions and for reporting enzyme activity data (http://www.beilstein-institut.de/en/projects/strenda/guidelines).

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 bacterial taxa (kingdoms, phyla, classes, orders, families, genera, species, and subspecies) are printed in italics and should be 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 Typhimurium. After the first use, the serovar may also be given without a species name: *Salmonella* Typhimurium, *S.* Typhimurium, or *Salmonella* serovar Typhimurium. For other information regarding serovar designations, see *Antigenic Formulae of the Salmonella Serovars*, 9th ed. (P. A. D. Grimont and F.-X. Weill, WHO Collaborating Centre for Reference and Research on Salmonella, Institut Pasteur, Paris, France, 2007; see http://www.scacm.org/free/Antigenic%20Formulae%20of%20the%20Salmonella%20Serovars%202007%209th%20edition.pdf). For a summary of the current standards for *Salmonella* nomenclature and the Kaufmann-White criteria, see the article by Brenner et al. (J Clin Microbiol 38:2465–2467, 2000), the opinion of the Judicial Commission of the International Committee on Systematics of Prokaryotes (Int J Syst Evol Microbiol 55:519–520, 2005), and the article by Tindall et al. (Int J Syst Evol Microbiol 55:521–524, 2005).

The spelling of bacterial names should follow the *Approved Lists of Bacterial Names (Amended) & Index of the Bacterial and Yeast Nomenclatural Changes* (V. B. D. Skerman et al., ed., American Society for Microbiology, Washington, DC, 1989) and the validation lists and notification 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: Prokaryotic Nomenclature Up-to-Date (https://www.dsmz.de/bacterial-diversity/prokaryotic-nomenclature-up-to-date.html) and the List of Prokaryotic Names with Standing in Nomenclature (http://www.bacterio.net/). If there is reason to use a name that does not have standing in nomenclature, the name should be enclosed in quotation marks in the title and at its first use in the abstract and the text and an appropriate statement concerning the nomenclatural status of the name should be made in the text. "*Candidatus*" species should always be set in quotation marks.

For guidelines regarding new names and descriptions of new genera and species, see the articles by Tindall (Int J Syst Bacteriol 49:1309–1312, 1999) and Stackebrandt et al. (Int J Syst Evol Microbiol 52:1043–1047, 2002). To validate new names and/or combinations, authors must submit three copies of their published article to the *International Journal of Systematic and Evolutionary Microbiology*.

It is recommended that a strain be deposited in at least two recognized culture collections in different countries when that

strain is necessary for the description of a new taxon (Int J Syst Evol Microbiol 50:2239–2244, 2000).

Since the classification of fungi is not complete, it is the responsibility of the author to determine the accepted binomial for a given organism. Sources for these names include *The Yeasts: a Taxonomic Study*, 5th ed. (C. P. Kurtzman, J. W. Fell, and T. Boekhout, ed., Elsevier Science, Amsterdam, Netherlands, 2011), and *Dictionary of the Fungi*, 10th ed. (P. M. Kirk, P. F. Cannon, D. W. Minter, and J. A. Stalpers, ed., CABI International, Wallingford, Oxfordshire, United Kingdom, 2008); see also http://www.speciesfungorum.org/Names/Fundic.asp.

Names used for viruses should be those approved by the International Committee on Taxonomy of Viruses (ICTV) and reported on the ICTV Virus Taxonomy website (https://talk.ictvonline.org/). In addition, the recommendations of the ICTV regarding the use of species names should generally be followed: when the entire species is discussed as a taxonomic entity, the species name, as with other taxa, is italic and has the first letter and any proper nouns capitalized (e.g., *Tobacco mosaic virus*, *Murray Valley encephalitis virus*). When the behavior or manipulation of individual viruses is discussed, the vernacular (e.g., tobacco mosaic virus, Murray Valley encephalitis virus) should be used. 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 or 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.

For submissions on the topic of probiotics, the Food and Agriculture Organization and World Health Organization (FAO/WHO) definition must be used: "live microorganisms, which when administered in adequate amounts, confer a health benefit on the host." To avoid any misrepresentation of how this term should be applied, authors are encouraged to read the FAO/WHO Guidelines published in 2002 (http://www.who.int/foodsafety/fs_management/en/probiotic_guidelines.pdf).

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.

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, a series of nucleic acid polymerase mutants might be designated Pol1, Pol2, and 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^r for streptomycin resistance). Phenotypic designations should be defined.

(ii) Genotypic designations are also 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: the Coli Genetic Stock Center (http://cgsc2.biology.yale.edu/). For the genus *Salmonella*, the registry is the *Salmonella* Genetic Stock Centre (http://people.ucalgary.ca/~kesander/). For the genus *Bacillus*, the registry is the *Bacillus* Genetic Stock Center (http://www.bgsc.org/).

(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 defined at the first occurrence in the text.

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 $his_{K\text{-}12}$ for the *his* gene of *E. coli* or strain K-12, respectively, may be used

to distinguish this gene from the *his* gene in another species or strain. 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(*hisQ-hisJo*)*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*::Tn*5*. 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 making a direct or parenthetical remark in the genotype, e.g., (F$^-$), ΔMu *c*ts, or *mal*::ΔMu *c*ts::*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*$^+$).

For information about the symbols in current use, consult Berlyn (Microbiol Mol Biol Rev 62:814–984, 1998) for *E. coli* K-12, Sanderson and Roth (Microbiol Rev 52:485–532, 1988) for *Salmonella* serovar Typhimurium, Holloway et al. (Microbiol Rev 43:73–102, 1979) for the genus *Pseudomonas*, Piggot 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*, 2nd ed. (A. I. Laskin and H. A. Lechevalier, ed., CRC Press, Inc., Cleveland, OH, 1988), 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, orthologous 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 database includes an updated listing of *E. coli* gene names and gene products. It is accessible on the Internet (http://cgsc2.biology.yale.edu/index.php). 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.

For prokaryotes, gene names should not begin with prefixes indicating the genus and species from which the gene is derived. (However, subscripts may be used where necessary to distinguish between genes from different organisms or strains, as described in section v of "Bacteria" above.) For eukaryotes, such prefixes may be used for clarity when discussing genes with the same name from two different organisms (e.g., Sc*URA3* versus Ca*URA3*); the prefixes are not considered part of the gene name proper and are not italicized.

Locus tags. Locus tags are systematic, unique identifiers that are assigned to each gene in GenBank. All genes mentioned in a manuscript should be traceable to their sequences by the reader, and locus tags may be used for this purpose in manuscripts to identify uncharacterized genes. In addition, authors should check GenBank to make sure that they are using the correct, up-to-date format for locus tags (e.g., uppercase versus lowercase letters and the presence or absence of an underscore, etc.). Locus tag formats vary between different organisms and also may be updated for a given organism, so it is important to check GenBank at the time of manuscript preparation.

"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 have 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. When using "percent sequence similarity," the method/algorithm used to calculate the percentage should be stated.

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").

"Natural" versus "artificial" transformation. Natural transformation is a process whereby the recipient cell has the in-

herent capacity to take up and integrate exogenous DNA into its genome. As such, natural transformation is part of the biology of the recipient cell line and should not be confused with processes through which integration of DNA is forced upon recipient cells.

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 *A*am11 *int*2 *red*114 *c*I857; this strain carries mutations in genes *c*I, *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 that 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 reports by Szybalski and Szybalski (Gene 7:217–270, 1979) and Echols and Murialdo (Microbiol Rev 42:577–591, 1978).

Eukaryotes. FlyBase (http://flybase.org/) is the genetic nomenclature authority for *Drosophila melanogaster*. WormBase (http://www.wormbase.org/#01-23-6) is the genetic nomenclature authority for *Caenorhabditis elegans*. When naming genes for *Aspergillus* species, the nomenclature guidelines posted at http://www.aspergillusgenome.org/Nomenclature.shtml should be followed, and the *Aspergillus* Genome Database (http://www.aspgd.org/) should be searched to ensure that any new name is not already in use. The *Saccharomyces* Genome Database (https://www.yeastgenome.org/) and the *Candida* Genome Database (http://www.candidagenome.org/) are authorities for *Saccharomyces cerevisiae* and *Candida albicans* genetic nomenclature, respectively.

For more information about the genetic nomenclature of eukaryotes, see the Instructions to Authors for *Molecular and Cellular Biology*.

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

The system of designating transposon insertions at sites where there are no known loci, e.g., *zef-123*::Tn*5*, 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′ factors, and of Roberts et al. (Nucleic Acids Res 31:1805–1812, 2003) for restriction enzymes, DNA methyltransferases, homing endonucleases, and their genes 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.

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). 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 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) demonstrat*ed* that XYZ cells *grow* at pH 6.8," "Figure 2 show*s* that ABC cells fail*ed* 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 inhibit*ed* . . . ."

For an in-depth discussion of tense in scientific writing, see *How To Write and Publish a Scientific Paper*, 7th 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*, 1992) 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, and Leu, etc.) may also be used.

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)	cRNA (complementary RNA)
cDNA (complementary DNA)	RNase (ribonuclease)
RNA (ribonucleic acid)	DNase (deoxyribonuclease)

rRNA (ribosomal RNA)
mRNA (messenger RNA)
tRNA (transfer RNA)
AMP, ADP, ATP, dAMP, ddATP, and GTP, etc. (for the respective 5′ phosphates of adenosine and other nucleosides) (add 2′-, 3′-, or 5′- when needed for contrast)
ATPase and dGTPase, etc. (adenosine triphosphatase and 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) and poly(dT), etc. (polyadenylic acid and 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)
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)
approx (approximately)
avg (average)
concn (concentration)
diam (diameter)
expt (experiment)
exptl (experimental)
ht (height)
mo (month)
mol wt (molecular weight)
no. (number)
prepn (preparation)
SD (standard deviation)
SE (standard error)
SEM (standard error of the mean)
sp act (specific activity)
sp gr (specific gravity)
temp (temperature)
vol (volume)
vs (versus)
wk (week)
wt (weight)
yr (year)

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 10^3. 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.

For a review of some common errors associated with statistical analyses and reports, plus guidelines on how to avoid them, see the articles by Olsen (Infect Immun 71:6689–6692, 2003; Infect Immun 82:916–920, 2014).

For a review of basic statistical considerations for virology experiments, see the article by Richardson and Overbaugh (J Virol 79:669–676, 2005).

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, or 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.

Phylogenetic trees based on nucleotide or amino acid sequence alignments must be supported by appropriate statistical analyses of tree stability (e.g., bootstrap analysis), and nonsupported branches (e.g., bootstrap coefficients below 50%) should be collapsed. A copy of the alignment should be available for examination by the editor or the reviewers upon request.

For a review of some common errors associated with statistical analyses and reports, plus guidelines on how to avoid them, see the articles by Olsen (Infect Immun 71:6689–6692, 2003; Infect Immun 82:916–920, 2014).

For a review of basic statistical considerations for virology experiments, see the article by Richardson and Overbaugh (J Virol 79:669–676, 2005).

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 variables and constants (but not numerals), and use roman type for designations: E_0, E_h, M_r, K_m, K_s, $a + 2b = 1.2$ mM, Ca^{2+} $V_{max} = \exp(1.5x + y)$, $BOD = 2.7x^2$.

Isotopically Labeled Compounds

For simple molecules, isotopic labeling is indicated in the chemical formula (e.g., $^{14}CO_2$, $^3H_2$, and $H_2{}^{35}SO_4$). 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., ^{32}S-ATP) or to a word that is not a specific chemical name (e.g., ^{131}I-labeled protein, ^{14}C-amino acids, and ^{3}H-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
L-[*methyl*-^{14}C]methionine
[2,3-^{3}H]serine
[α-^{14}C]lysine
[γ-^{32}P]ATP
UDP-[U-^{14}C]glucose
E. coli [^{32}P]DNA
fructose 1,6-[1-^{32}P]bisphosphate

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Author Checklist

Below is a quick checklist of formatting issues that we commonly ask authors to address. This list is not all-inclusive. Authors are encouraged to review the Instructions to Authors for more guidelines and details. If this is a revision/resubmission, specific issues identified by the editor, reviewers, and/or ASM staff are listed in your decision letter; be sure to review and address these issues.

Page Format/Length	☐	Double-space and left-justify the manuscript; use 12-point type and 1-inch margins; use portrait layout for 8.5″ × 11″ paper. Add continuous line numbers and page numbers to assist editors/reviewers. Note also that AEM no longer publishes short-form papers.
Title page	☐	On the title page (first page of your manuscript), include the full working title, author byline with all authors' full names and affiliations, contact information for the corresponding author(s) (note that there may be two), and keywords.
First-Time Claims	☐	First-time claims should be avoided.
Abstract/Importance	☐	Most article types require an abstract (see the Instructions to Authors for exceptions and for specific word limits). The abstract should concisely summarize the content of the paper without presenting extensive experimental details.
	☐	For Research Articles, include a separate Importance paragraph of ≤150 words. This is a nontechnical explanation of why the work was undertaken.
References	☐	The numbered citation (citation-sequence) reference method should be used. List and number references in the References section in the order in which they are cited in the text. Include the names of all authors for each work cited (instead of "et al.").
	☐	Refer to the Instructions to Authors for specific formatting instructions.
Tables	☐	Place all tables after the References section.
	☐	Create tables using the Table function of Microsoft Word (preferably without using the spacing and tabbing features). Arrange the data so that columns of like material read down, not across.
	☐	Create fully descriptive table captions and place them above the body of the table. Create footnotes for content that does not conveniently fit in the title or in data cells. Use superscript lowercase italic letters in alphabetical order as the footnote symbols (*a*, *b*, *c*, etc.).
Figures	☐	Place all figures after the References section and after tables, if any.
	☐	On initial submission, figures may be supplied as PDF files. For revisions, they must be supplied as individual TIFF or EPS files. PowerPoint files are NOT accepted.
	☐	Multipanel figures must be assembled in a single file (and onto one page if at all possible).
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