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INFORMATION TO CONTRIBUTORS
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Purpose and scope
The Proc. Nat. Acad. Sci. USA publishes brief reports (not previously published) of the results of original research by members of the Academy or by others if the communication is sponsored by an Academy member. Articles should be as brief as adequate presentation allows, and may not exceed five printed pages. Since the Proceedings publishes papers in all branches of science represented in the Academy, it is desirable, whenever possible, for articles to be written so as to be intelligible to a wide scientific audience. Both because of the space limitations and the broad scientific audience of the Proceedings, detailed scientific papers may often be more appropriately submitted to more specialized journals.

Sometimes, preliminary findings of major importance are published in the Proceedings without full documentation; authors must indicate that the paper is a preliminary one and that a detailed report will be published elsewhere.

Upon invitation from the Editorial Board, some papers presented at Academy symposia, special Academy lectures, or papers on subjects of general interest to scientists are also published in the Proceedings.

Conditions for submission
Manuscripts will be accepted only from members of the Academy, who will assume responsibility for their propriety and scientific standards. In communicating an article on behalf of a nonmember, an Academy member should explicitly state that it contains findings of more than ordinary importance to investigators working on related problems, or of particularly broad interest to diverse groups of scientists. No Academy member may sponsor more than 10 papers in any annual volume.

Before submitting an article on behalf of a nonmember, an Academy member must also obtain a written opinion on it by a qualified referee. For maximal objectivity in the reviewing process, it is highly desirable that the member select the referee himself and that he not divulge the referee’s identity to the author, at least until the member receives the comments. Ordinarily, the referee should not be a close colleague or former mentor of the author or a member of the Academy member’s department. Forms on which the referee’s comments should be submitted are provided on request by the Proceedings Office. The Academy member must enclose a copy of the referee’s report with his letter of transmittal. He retains the privilege of communicating the paper if the referee’s report is unfavorable, but in that case he should state in his letter of transmittal his reasons for disagreeing with the referee.

Papers are generally processed rapidly for publication; however, the Editorial Board reserves the right to subject manuscripts to further review when this seems desirable and to reject papers if they do not meet the general criteria for publication, as defined by the By-Laws of the Academy.

No person may be author or coauthor of papers totaling more than five pages in any one issue.

Manuscripts reporting experiments with humans should be accompanied by a copy of the document authorizing the proposed research by the responsible institutional committee. Authors are referred to the Declaration of Helsinki for further guidance.

Page charges are assessed for all communicated papers. A member of the Academy who communicates an article on behalf of a nonmember author is responsible for the costs of publishing the paper; if a nonmember author is to be billed for the page charges, the member communicating the paper should make sure that there is a clear understanding to this effect with the author before the paper is communicated. Members may not use the annual publishing allowances extended them by the Academy for the payment of the costs of publishing papers by other authors. The standard charge is now $75 per printed page; in addition, authors may be billed for the costs of extensive changes made in proof and for other items of special cost.

Manuscripts are to be submitted in duplicate to the Proceedings of the National Academy of Sciences, Room 253, 2101 Constitution Avenue, Washington, D.C. 20418. Those that are in good form can usually be published 8–13 weeks later. If articles are to be published on schedule, it is essential that communicated manuscripts are in the form in which authors wish their papers to appear and that their length be appropriate for the Proceedings. Authors are encouraged to submit their manuscripts typewritten on double-spaced manuscript paper with numbered lines whenever possible.

Length
Five printed pages will accommodate about 5500 words. The title and the heading material usually occupy space equivalent to about 600 words. Appropriate allowance should be made for the space occupied by references, footnotes, tables, and figures with their legends. Figures will be scaled to one- or two-column width according to the size of the lettering (see Illustrations below).

Articles estimated on first receipt as longer than five pages will be returned to authors for shortening without further editorial consideration.

Illustrations
Present only such illustrative material as is essential for the point being made. Drawings made for slide projection are rarely suitable for publication. Design line drawings to fit into one- or two-column width with minimum wasted space. Thin-stroke lettering should be used in sizes such that after reduction the smallest letter or numeral will not be less than 1.5 mm in height. Avoid extraneous detail in figures; use the legends for details as to cell type used, identification of symbology, etc.

All figures should be identified on the back with a soft pencil and the orientation should, if necessary, be indicated by means of an arrow and the word “top”. Do not mount figures unless a composite figure is desired. Indicate the magnification of photomicrographs in the legend, or include a bar indicating scale in the figure (or both).

Legends to figures should be typed double-spaced, in numerical order, on a separate page.

Tables
Tables should be typed double-spaced throughout, numbered with arabic numerals, and provided with titles (above the table). A list of footnotes to a table must be typed double-spaced, on a separate page if necessary. Reference to the footnotes should be made by means of the symbols *, †, ‡, §, ¶, ||, in that order, followed by doubled symbols if necessary. A lengthy list of footnotes is better keyed with lowercase superscript letters or, in exceptional cases where this would be confusing, with superscript numbers.

Title page
Provide a separate title page, containing the following items:
Classification. Give any one of the sciences named in the
titles of the sections of the Academy, or Immunology, Pathology, Cell Biology, or Statistics.

**Title.** This should be brief, specific, and rich in informative words. Add up to five amplifying key terms to alert readers, and computers, to subjects in the article not referred to in the title. The Proceedings discourages the use of uninformative serial titles such as On Steroids, XIX. If a paper is part of a series, indicate this by a symbolized footnote on the first page, and include a reference to the immediately preceding paper of the series.

**By-line.** If there are several authors with different affiliations, key authors to institutions by means of symbols *, †, ‡, §, ¶. If reprint requests are to be addressed to any but the first author, indicate this by a footnote.

**From-line.** List the institutions and provide Zip Codes.

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**Abstract**
Every paper must begin with an abstract, typed on a separate page. This should state the subject and main conclusions of the article in generally intelligible terms. Avoid abbreviations. The abstract must be intelligible to a reader before he reads the paper, and suitable for reproduction by abstracting services without rewriting. It should usually not exceed 250 words.

**Nomenclature**
The Proceedings strives for the greatest possible conformity with international standards on nomenclature. Guides and special considerations in different disciplines are listed below.

**Mathematics.** Notations that are expensive to typeset should be avoided by use of the devices given on p. 7 of the American Mathematical Society's Manual for Authors (1970): for example, replace $\frac{a}{b}$ by $a/b$, $e^x$ by $\exp(x)$, $\bar{r}$ by $r$ (denoted in manuscript by a wavy underline). Manuscripts in which this has not been done may be returned to the author.

Provide a list of special characters used in the paper for the printer's guidance, and identify all Greek, Hebrew, or script letters by means of marginal notes at their first appearance.

**Physics.** Use the American Institute of Physics' Style Guide (revised 1969).

**Chemistry.** Use the American Chemical Society's Handbook for Authors (1967).


Enzymes should be given their recommended names on first mention, together with the Enzyme Commission (EC) number when this has been assigned.

**Abbreviations**

**Standard Abbreviations** for units of measure and for certain substances (e.g., DNA) are listed in the style manuals and handbooks named above. These need not be spelled out. Some standard abbreviations and symbols whose correct form is not familiar to all authors are listed on the following pages. Rules of the IUPAC-IUB Commission on Biochemical Nomenclature are followed [see J. Biol. Chem. (1966) 241, 527 and J. Mol. Biol. (1971) 55, 299, for example, for guidance].

**Nonstandard Abbreviations** are defined as those not given in the handbooks' lists, even if they may be familiar to those in the field. (a) Keep them to a minimum, and only for cumbersome words that must be used more than five times in the paper. (b) Spell out nonstandard abbreviations at their first appearance in the text. (c) If possible, avoid them completely in the Abstract. (d) List them on the title page for inclusion as a footnote on the first printed page of the article.

**References**
Cite references in order throughout the text by means of arabic numerals (not superscript) between parentheses (in mathematical papers, square brackets may be used to avoid confusion with numbered equations, or the reference number may be preceded by "ref."). Citations are to be made in this way only to papers already published or "in press" in a stated journal or other publication. Any reference to unpublished work should be made in the text or, rarely, in the form of a symbolized footnote. Reference to "personal communication" should also be made in the text; written approval by the person cited should accompany the manuscript.

We encourage the provision of titles and require inclusive pagination for articles cited. References must be typed double-spaced in the style used by the Proceedings, thus (for journal articles):


Titles of journals should be abbreviated according to the American National Standard for the Abbreviation of Titles of Periodicals (see ACCESS or BIOSIS List of Periodicals).

For references to articles in books, the following sequence should be maintained: author(s), year of publication in complete title of book, names of editors (if applicable), (name of publishers, place of publication), page numbers if necessary, thus:


It is extremely important that the final typed list of references be checked for accuracy against the original articles or photocopies of them.

**Acknowledgments**
Keep acknowledgments brief. Acknowledgments to persons usually precede those for grant support. They should be typed double-spaced.
SOME STANDARD AND RECOMMENDED ABBREVIATIONS AND SYMBOLS

For simplicity, one preferred abbreviation or symbol has been adopted in most cases, even though the handbooks listed below may give equally favored alternatives.

absorbance

N-acetylglucosamine

asparaginyl

aspartyl

asparaginyl or aspartyl

5-bromodeoxyuridine

cyclic AMP (3':5')
cysteiny1

deoxy (carbohydrates and nucleotides)
deoxyribonucleosase
deoxyribonucleotide acids

2,4-dinitrophenyl

formylmethionyl

glucone

guanosine

gluconic acid

glucoamine

gluconic acid

glutaminyl

glutamyl

glutamyl or glutamyl

hemoglobin

immunoglobulin G(M)

A (not OD)

GlcNAc

Asn

Asx

BrdU (not BuDr)*
cAMP

Cys

dNase

DNAs

Dnp- or Nph§
fMet

G or G1e†

G or Guo†

GlcA

GlcN

GlcUA

Glu

Gln

Glx

Hb

IgG(IgM)

*

†

§

Similarly for other halogenated nucleosides.

† Use 3-letter abbreviation when G can be ambiguous.

§ Preferred by IUPAC-IUB.

Isotopes. The mass number of an atom should be written as a superior prefix: 14C, not C14; 18O, not S. Enclose the symbol for the isotope in square brackets placed immediately before the name or abbreviation of the compound: [14]C].[18]O; [14]C]urea; [α-14C]leucine; [carboxy-14C]leucine; (α,β-14C]maleic anhydride; L-[methyl-14C]methionine. The symbol U denotes uniform labeling, e.g., [U-14C]glucose. With chemical formulas, use 14CO2, H218O, etc. (no square brackets). For fully deuterated solvents use, for example, [U-2H]pyridine or C2H2N.

Peptide Symbols. For peptides of known sequence, represent the CO–NH bonds by hyphens, as in Gly-Tyr-Ala. Groups of residues of unknown sequence are enclosed in parentheses and separated by commas (see J. Biol. Chem. 247, 977 and 323).

Nucleotide Symbols. Use A, C, G, I, ψ, T, U, X for residues of adenosine, cytidine, guanidine, inosine, pseudouridine, inosinic acid, xanthosine, hypoxanthosine, guanine, guanosine, cytidine, cytosine, thymine, uracil, thymidine, uridine, and xanthosine (N, not X, for unknown nucleotide) in 3′-5′ linkages; dA, dC, etc., for corresponding deoxy compounds. End phosphoribosyl residues are specified by p, internal (phosphodiester) phosphoribosyl residues by a hyphen. Synthetic polynucleotides: poly is always to be followed by parentheses, without intervening space, thus poly(A). Phosphodiester bonds are denoted by hyphens, thus poly(dA-dT) for a polymer of alternating adenosine and thymidine residues. Random or unknown order is denoted by commas, thus poly(dA, dT). Indicate noncovalent associations by a center dot, thus poly(I).poly(C). RNA·DNA hybrids.

Transfer RNAs that accept specific amino acids are designated thus: 5′RNAAla (“alanine tRNA”). When the tRNA is bound to an amino-acid residue, use alanyl-tRNA (alanyl-tRNAAla if necessary) or, e.g., fMet-tRNA.

HANDBOOKS AND STYLE MANUALS


Abbreviations of Units of Measurement and of Physical and Chemical Quantities
(These abbreviations may be used without definition. They are not normally followed by periods except as shown.)

<table>
<thead>
<tr>
<th>Prefixes to the Names of Units</th>
<th>Physical and Chemical Quantities—Continued</th>
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<tbody>
<tr>
<td>giga</td>
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<td>mega</td>
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* Term such as milligram percent (mg%) should not be used. Weight concentrations should be given as g per ml, g per 100 ml, g per liter, etc.
† The letter M is not an abbreviation for mole; it is reserved for molar. Use mM for 10⁻³ M and μM for 10⁻⁶. Avoid designating concentrations as μmol per ml, for example. The designation should, in this case, properly be mM (i.e., millimolar). Maintain consistency in the use of units in situations where they are to be compared (e.g., do not juxtapose 10⁻⁴ M and 10⁻⁶ M).
‡ The PROCEEDINGS will continue to accept certain units as listed (e.g., Angstrom, calorie, minute) even though they are not part of the Système Internationale. Note that nanometer is preferred instead of millimicron or Angstrom units.
§ Use °C abbreviation if ° could be ambiguous.
¶ The Système Internationale (SI) recommends joules. When calories are used the equivalent value in joules should be given (1 calorie = 4.184 joules).