INFORMATION TO CONTRIBUTORS

(Revised 1977)

Purpose and scope

The Proceedings of the National Academy of Sciences USA publishes reports that describe the results of original theoretical or experimental research of exceptional importance or novelty. Reports are accepted only if contributed by a member of the Academy or communicated by an Academy member on behalf of a nonmember and have not been submitted for publication or previously published elsewhere.

Because the PROCEEDINGS publishes papers in all branches of science represented in the Academy, articles should be of interest and intelligible to a broad scientific audience.

Occasionally, preliminary findings of major importance may be published in the PROCEEDINGS without full documentation; in such cases, the author must indicate the preliminary character of the paper and where a subsequent detailed report will be published.

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

Procedures for submitting manuscripts

Manuscripts that meet the criteria listed below should be sent, in duplicate, to the PROCEEDINGS of the NATIONAL ACADEMY OF SCIENCES USA, Room 253, 2101 Constitution Avenue, Washington, D.C. 20418. Manuscripts that meet all criteria are usually published within 8–13 weeks. However, as authorized by the Bylaws of the Academy, the Editorial Board reserves the right to subject manuscripts to further review when necessary and to reject those that do not meet the general criteria for publication or are regarded as inappropriate in some significant way.

Manuscripts are accepted only from members of the National Academy of Sciences. These members assume responsibility for the propriety and scientific standards of the manuscripts that they submit. An Academy member may contribute and/or communicate a maximum of 10 papers in any calendar year.

New members may submit manuscripts as soon as a letter of membership acceptance is received by the Home Secretary's Office.

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

Before communicating an article on behalf of nonmember(s), an Academy member must obtain signed written opinions of the paper from two qualified referees. Only the member should select the referees; their names should be divulged to the author only at the member's discretion and after he has reviewed their comments. Referees should be chosen solely for their impartiality and their ability to judge the work. Forms for the referees' comments are provided to members on request to the PROCEEDINGS Office. An author should see all referee queries before the paper is forwarded to the PROCEEDINGS Office.

The Academy member should send signed copies of both referee reports with the manuscript and letter of communication. The member may communicate a paper for which a referee report is unfavorable, but in this case the reasons for so doing should be stated. Because only members are privileged to communicate manuscripts to the PROCEEDINGS, the letter of communication must come from and be signed by the member.

In the letter of communication on behalf of a nonmember, an Academy member should indicate explicitly that the report is particularly novel, of exceptional importance, or of broad interest to diverse groups of scientists. In addition, if a nonmember is to be billed for page charges (currently $55 per page), then the member should identify which author has agreed to pay the charges; otherwise, the Academy member is responsible for the cost of publication. Authors are also billed for the costs of extensive changes made in proof, for color reproductions, and for other special items.

It is useful to include the name and telephone number of the specific author responsible for reviewing the galley proof.

Manuscripts that report research involving either human subjects or the use of materials of human origin must be accompanied by a copy of the document authorizing the proposed research, issued and signed by the appropriate official(s) of the institution where the work was conducted. Authors are referred to the Declaration of Helsinki for further guidance.

For animal experimentation reported in the PROCEEDINGS, it must be clear that the conditions conformed to the Guiding Principles in the Care and Use of Animals approved by the Council of the American Physiological Society.

Manuscripts that report recombinant DNA research should state, in the Materials and Methods section, the physical and biological containment levels used, as outlined in the "National Institutes of Health Recombinant DNA Research Guidelines, Part II" (see Federal Register, July 7, 1976).

When reference is made to a personal communication, unpublished work, or a paper in press that does not involve at least one author of the manuscript sent to the PROCEEDINGS, it is the submitting author's responsibility to furnish a statement that authorizes the citation of such material and is signed by one of the persons cited.

Receipt of each manuscript is acknowledged by the PROCEEDINGS Office; the author should notify this office if an acknowledgment has not been received within a reasonable period. Academy members or authors should call the PROCEEDINGS Office if they have questions on these or other matters. When calling on manuscript-related matters, an author should indicate the manuscript number and scheduled month of publication. The telephone number is (202) 389-6871.

No manuscript in any scientific discipline is exempt from these requirements and the requirements for manuscript preparation noted below. Failure to provide all the necessary documentation when the manuscript is submitted may delay publication.

Manuscript preparation

Length. Articles should be as brief as full documentation allows. They may not exceed five printed pages (approximately 5500 words). The title, key terms, names of authors and their affiliation(s), and statement of communication or contribution usually occupy space equal to about 600 words. Appropriate allowance must be made for the space occupied by footnotes, references, tables, and figures with their legends. Figures are scaled to a one- or two-column width at the PROCEEDINGS Office, according to the size of the lettering used (see Illustrations, below). Instructions for calculating the length of a manuscript are available from the PROCEEDINGS Office. However, responsibility for final measurements of manuscript length is retained by the PROCEEDINGS Office.

Articles estimated to exceed five pages will be returned for shortening without further editorial consideration.

Manuscripts must be typed, double-spaced throughout, on only one side of each page.

Title Page. Provide a title page containing only the following information:

Classification. Give any one of the sciences named in the titles of the Academy Sections with these exceptions: Sections
sections are 41 (Medical Genetics, Hematology, and Oncology), 42 (Medical Physiology, Endocrinology, and Metabolism), and 43 (Infectious Diseases and Immunology) are all listed as Medical Sciences; and Section 27 (Population Biology, Evolution, and Ecology) may be listed as Population Biology, Evolution, or Ecology. Additional headings that may be used but that are not Academy Sections are Biophysics, Immunology, Microbiology, and Statistics.

Title. The title should be brief, specific, and rich in informative words. Titles usually should not begin with such general words as “The,” “A,” “Results,” “Study,” or “Effect.” Titles should not include phrases in which more than three words modify another word (for example, “simian virus-transformed fetal mammalian heart fibroblast” should be written as “simian virus-transformed fibroblast from fetal mammalian heart”). The PROCEEDINGS does not use serial titles such as On Steroids, XIX. The serial title followed by a colon and the specific title may be used. Therefore, the title could be written On steroids: Metabolism of cortisone. If a paper is part of a series, this may be indicated by a symbol at the end of the title and a footnote: “This is paper no. 19 in a series. Paper no. 18 is ref. _____.” The preceding paper must then be included in the list of references.

Key Terms. These terms should be given below the title, enclosed within parentheses, and separated by a slash (/) mark. Up to five new terms, composed of words not used in the title, may be included to alert readers and indexers to other subjects in the paper.

Author Affiliation. The department, institution, city, state, and ZIP code or country for each author should be furnished. If there are several authors with different affiliations, authors should be matched to their respective institutions by means of superscript symbols after the authors’ names in this order: *, †, ‡, §, ¶, ‖. If an author has moved since doing the work described, indicate the institution at which the work was done in the primary affiliation listing and use an additional symbol and footnote to indicate the present address.

If reprint requests are to be addressed to an author other than the first one listed, also indicate this with a symbol as noted above and a footnote. The footnote should state: “To whom reprint requests should be addressed.”

Abbreviations Footnote. Only nonstandard abbreviations that are used five or more times throughout the paper should be listed in this section. The PROCEEDINGS discourages the use of acronyms, and manuscripts will be edited so that abbreviations are consistent with recommended international nomenclature. Nonstandard abbreviations should be kept to a minimum and should not be used in the title, key terms, or abstract. Introduce nonstandard abbreviations by defining where first mentioned in the text followed by the abbreviation in parentheses. Subsequently, the abbreviation only should be given.

Abstract Page. The second page of every paper must carry only the abstract. The abstract should be no longer than 250 words. It should state the subject and main conclusions of the article in generally intelligible terms. Abbreviations should be avoided unless used more than five times in the abstract. The abstract must be understandable to the reader before he reads the paper, suitable for reproduction without rewriting, and unambiguous without recourse to any other part of the manuscript, including title page.

Footnotes in Text. The number of footnotes should be kept to a minimum and they should be indicated in text by use of a symbol. Symbols should be used in the order *, †, ‡, §, ¶, ‖, but should not repeat symbols used earlier, particularly those of the title page.

Acknowledgments. All acknowledgments, including those for financial support, should be cited here rather than in footnotes and should be brief. Acknowledgments to people usually precede those for grant support. Abbreviations are not normally used except for an author’s name, where initials only with periods are used.

References. Cite references in numerical order as they appear in the text. Tables and figures will be inserted in the text where first cited, so references, if used, in these sections should be numbered accordingly. Use arabic numerals separated by commas (except for sequences of three or more when a dash is used between the first and last numeral) and enclose the references in parentheses. References may not be cited in any other order.

Only papers that are either published or in press may be cited in the reference list. Each reference is given a separate number; multiple citations under one numeral are not used. All other citations are shown directly in the text where first mentioned.

The full citation is given at the end of the manuscript. The PROCEEDINGS requires inclusive pagination, and the use of article and chapter titles is encouraged. If a reference is an abstract, then this should be noted in the citation, after the page numbers.

Journal articles are cited as follows:

For the correct abbreviations of journal titles, refer to either Chemical Abstracts Service Source Index (CASSI) or Bibliographic Guide for Editors and Authors (1974). Both are published by the American Chemical Society, Washington, D.C.

Articles or chapters in books are cited as follows:

Authors are responsible for the accuracy of the citations. Tables. Tables should be prepared so that they are self-explanatory. Vertical rules are not used to set columns apart, and horizontal rules are used sparingly. Tables should have a brief title and be numbered with Arabic numerals. Each table should be typed double-spaced throughout. Nonstandard abbreviations should be used sparingly and must be defined in the legend at the bottom of the table, if not defined in the abbreviations section on the title page. Each vertical column requires a heading. Reference to footnotes should be made by means of the symbols *, †, ‡, §, ¶, ‖, in that order. If more than six footnotes are required, then superscript lower-case letters should be used. For use of powers of 10, see section below.

Illustrations. Either original drawings or high-quality photographs are needed. Xerographic copies of illustrations are not acceptable. It is essential that, when illustrations are reduced for publication, they (i) fit into a one-column (85 mm) or two-column (175 mm) width and (ii) have letters no smaller than 1.5 mm in height. All illustrations should be identified on the reverse side by marking with a soft pencil. Where necessary, the orientation for the illustration should be indicated by means of an arrow and the word "top." Legends for the illustrations should be typed double-spaced, in numerical order, on a separate page.

Line drawings should be marked with index lines and labeled with scales on the x- and y-axes. Line drawings should also be enclosed on the top and right side of the figure and index lines only should be used there unless more than one x- or y-axis scale is plotted. Scales that involve large or small numbers should use numbers multiplied by powers of 10. The PROCEEDINGS uses the following convention: 3500 cpm is represented as 3 and the axis is labeled cpm X 10^-3. For maximal clarity, use both separate symbols and various lines (solid, broken, etc.). Keys to symbols and lines should be included in the legend, not on the
figure. It is particularly important that nomenclature, abbreviations, and units used in figures agree precisely with those used in the text of the paper. For electron micrographs and similar illustrative materials, authors should note that the quality of reproduction cannot exceed the quality of the submitted material. Do not mount illustrations unless a composite figure is required. Indicate the magnification of photomicrographs in the legend or include a bar in the figure to indicate the scale (or both).

Nomenclature. International standards on nomenclature should be used. The following guides are recommended:


Notations that are expensive to typeset should be avoided.

Some Standard Abbreviations

<table>
<thead>
<tr>
<th>Substance</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>absorbance</td>
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<td>acetate</td>
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</tr>
<tr>
<td>N-acetylglucosamine</td>
<td>GlcNAc</td>
</tr>
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<td>Ade</td>
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<td>Asn</td>
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<td>Asp</td>
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<tr>
<td>5-bromodeoxyuridine</td>
<td>BrdUrd</td>
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<td>HbCO</td>
</tr>
<tr>
<td>carbon monoxide myoglobin</td>
<td>MbCO</td>
</tr>
<tr>
<td>O-carboxymethylcellulose</td>
<td>CM-cellulose</td>
</tr>
<tr>
<td>coenzyme A</td>
<td>CoA</td>
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<tr>
<td>complementary DNA</td>
<td>cDNA</td>
</tr>
<tr>
<td>counts per minute</td>
<td>cpm</td>
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<tr>
<td>cysteine</td>
<td>Cys</td>
</tr>
<tr>
<td>cytidine</td>
<td>C, Cyd</td>
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<tr>
<td>cytosine</td>
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<tr>
<td>deoxy (carbohydrates and nucleic acids) d</td>
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<tr>
<td>deoxyribonucleic acid</td>
<td>DNA</td>
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<tr>
<td>diethylaminoethylcellulose</td>
<td>DEAE-cellulose</td>
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<tr>
<td>diphosphopyridine nucleotide</td>
<td>DPN*, DPNH</td>
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<tr>
<td>direct current</td>
<td>Dc</td>
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<tr>
<td>flavin-adenine dinucleotide</td>
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<td>flavin mononucleotide</td>
<td>FMN</td>
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<tr>
<td>formylmethionine</td>
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<td>GlcA</td>
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<td>glucosamine</td>
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<td>glucose</td>
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<td>glucuronide</td>
<td>GlcUA</td>
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<td>glutamic acid</td>
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<td>glutamic acid or glutamine</td>
<td>Glx</td>
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<td>glutamine</td>
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<td>glycine</td>
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<td>G, Guo</td>
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<tr>
<td>isoleucine</td>
<td>Ile</td>
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<td>isotopes</td>
<td>i^{14}C, 3^{2}P</td>
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<tr>
<td>lysine</td>
<td>Lys</td>
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<td>mannose</td>
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<td>messenger RNA</td>
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<td>methionine</td>
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<td>mitochondrial DNA</td>
<td>mtDNA</td>
</tr>
<tr>
<td>nicotinamide adenine dinucleotide</td>
<td>NAD+, NADH</td>
</tr>
<tr>
<td>nicotinamide adenine dinucleotide phosphate</td>
<td>NADP+, NADPH</td>
</tr>
<tr>
<td>nucleoside (unknown)</td>
<td>N, Nuc</td>
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<tr>
<td>optical density</td>
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<td>oxyhemoglobin</td>
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<td>phenylalanine</td>
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<tr>
<td>phosphate (in compounds)</td>
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<tr>
<td>polyanionic acid</td>
<td>poly(A)</td>
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<tr>
<td>proline</td>
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<td>rhesus factor</td>
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<tr>
<td>ribonuclease</td>
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<td>ribonucleic acid</td>
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<td>ribose</td>
<td>Rib</td>
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<td>ribosomal ribonucleic acid</td>
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<tr>
<td>ribosylthymine</td>
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<td>serine</td>
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<tr>
<td>threonine</td>
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<td>thymidine (2'-deoxyribosylthymine)</td>
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<tr>
<td>transfer RNA</td>
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<td>triphosphopyridine nucleotide</td>
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<tr>
<td>uridine</td>
<td>U, Urd</td>
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<tr>
<td>valine</td>
<td>Val</td>
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</table>

Notes:

- Use absorbance, A, for light absorption by solutions; use optical density, OD, for light transmission through turbid suspensions.
- The 5' mono-, di-, and triphosphate derivatives are abbreviated as AMP, ADP, ATP; other nucleoside 5'-phosphates are abbreviated similarly. cAMP (adenosine 3',5'-cyclic monophosphate) and cGMP (guanosine 3',5'-cyclic monophosphate) are not considered standard.
- Similarly abbreviate other substituted purines, pyrimidines, and nucleosides.
- Use only in sequence descriptions, tables, or figures.
- Provide a list of special characters used in the paper for the printer, and identify Greek, Hebrew, or script letters in the margin at the line where they first appear.

The second Life Sciences reference contains the International Union of Biochemistry rules of nomenclature for amino acids, peptides, nucleic acids, polynucleotides, vitamins, coenzymes, quinones, folic acid and related compounds, cornioids, lipids, enzymes, proteins, cyclitols, steroids, carbohydrates, carotenoids, peptide hormones, and human immunoglobulins.

Enzymes should be given the recommended name followed by the systematic name and Enzyme Commission (EC) number on first mention, both in the abstract and text. For guidance refer to: Enzyme Nomenclature: Recommendations (1972) of the International Union of Pure and Applied Chemistry and the International Union of Biochemistry (1975). American Elsevier Publishing Co., Inc., 52 Vanderbilt Avenue, New York, N.Y. 10017. See also Supplement 1: Corrections and Additions (1975).

Genetics. A guide to nomenclature in bacterial genetics may be found in: Demerec, M., Adelberg, E. A., Clark, A. J. & Hartman, P. E. (1966) Genetics 54, 61–76. Note that genotypes are italicized (underlined in typed copy); phenotypes are not.

Immunology. For human immunoglobulins and their genetic factors use the rules of the World Health Organization or the reference for Life Sciences above.

Abbreviations and Symbols. The PROCEEDINGS distinguishes between standard and nonstandard abbreviations. Standard abbreviations for certain substances and units of measure listed here do not need to be defined. Most, if not all, other abbreviations are considered to be nonstandard, should be kept to a minimum, and must be spelled out on first usage. Nonstandard abbreviations should be used only for terms mentioned five or more times in the paper (for such cases, see information about Title Page).


Abbreviations for Units of Measurement and of Physical and Chemical Quantities

<table>
<thead>
<tr>
<th>Prefixes to the Names of Units</th>
<th>Units of Energy and Work</th>
<th>Units of Temperature</th>
<th>Units of Radioactivity</th>
<th>Miscellaneous Units</th>
<th>Physical and Chemical Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>exam</td>
<td>E</td>
<td>milli</td>
<td>J</td>
<td>degree centigrade or Celsius</td>
<td>counts per minute</td>
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<td>petam</td>
<td>P</td>
<td>micro</td>
<td>calorie</td>
<td>thermodynamic temperature (kelvin)</td>
<td>curie(s)</td>
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<td>T</td>
<td>nano</td>
<td>cal</td>
<td></td>
<td>Ci</td>
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<td>G</td>
<td>pico</td>
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<td>femto</td>
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<td>atto</td>
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<td>Units of Concentration*</td>
<td>Units of Energy and Work</td>
<td>Units of Temperature</td>
<td>Units of Radioactivity</td>
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<td>Physical and Chemical Quantities</td>
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<tr>
<td>molar (mol/liter)</td>
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<tr>
<td>parts per million</td>
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<td>Units of Radioactivity</td>
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<td>meter</td>
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<td>micrometer (not micron)</td>
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<td>nanometer</td>
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<td>Units of Electricity</td>
<td>Units of Energy and Work</td>
<td>Units of Temperature</td>
<td>Units of Radioactivity</td>
<td>Miscellaneous Units</td>
<td>Physical and Chemical Quantities</td>
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* For units of concentration based on molecular weight, the mole is used. Weight concentrations should be given as g/ml, g/liter, ppm etc.; mg% is not acceptable.

† Liter should not be abbreviated unless used with a prefix.

The PROCEEDINGS uses units that are part of the Système International (SI). When such units are not used, the SI equivalent should be given in parentheses where first mentioned.
NATIONAL ACADEMY OF SCIENCES
JULY 1, 1977

OFFICERS

President—Philip Handler
Vice-President—Saunders Mac Lane
Home Secretary—David R. Goddard
Foreign Secretary—George S. Hammond
Treasurer—E. R. Piore

Term expires
June 30, 1981
June 30, 1981
June 30, 1979
June 30, 1978
June 30, 1980

Executive Officer
John S. Coleman

Comptroller
David Williams

Business Manager
Bernard L. Kropp

COUNCIL

Anderson, Philip W. (1979)
Bing, R. H. (1980)
Bloembergen, Nicolaas (1978)
Crawford, Bryce, Jr. (1978)
Goddard, David R. (1979)
Gomory, R. E. (1978)
Gunsalus, Irwin C. (1978)
Hammond, George S. (1978)
Handler, Philip (1981)
Lehninger, A. L. (1979)

Mac Lane, Saunders (1981)
Markert, C. L. (1980)
Stetten, DeWitt, Jr. (1979)
Westheimer, Frank H. (1979)
SECTIONS

The Academy is divided into the following Sections, to which members are assigned at their own choice:

(11) Mathematics  (31) Engineering
(12) Astronomy  (32) Applied Biology
(13) Physics  (33) Applied Physical and Mathematical Sciences
(14) Chemistry  
(15) Geology  (41) Medical Genetics, Hematology, and Oncology
(16) Geophysics  
(21) Biochemistry  (42) Medical Physiology, Endocrinology, and Metabolism
(22) Cellular and Developmental Biology  
(23) Physiological Sciences  (43) Medical Microbiology and Immunology
(24) Neurobiology  
(25) Botany  (51) Anthropology
(26) Genetics  (52) Psychology
(27) Population Biology, Evolution, and Ecology  (53) Social and Political Sciences
(28) Genomics  (54) Economic Sciences

In the alphabetical list of members, the numbers in parentheses, following year of election, indicate the respective Class and Section of the member.

CLASSES

The members of Sections are grouped in the following Classes:

I. Physical and Mathematical Sciences (Sections 11, 12, 13, 14, 15, 16).
II. Biological Sciences (Sections 21, 22, 23, 24, 25, 26, 27).
III. Engineering and Applied Sciences (Sections 31, 32, 33).
IV. Medical Sciences (Sections 41, 42, 43).
V. Behavioral and Social Sciences (Sections 51, 52, 53, 54).

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Class IV: Chairman—James G. Hirsch (1980)
           Secretary—Alexander G. Bearn (1980)
Class V: Chairman—Theodore W. Schultz (1980)
           Secretary—William H. Sewell (1980)
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Anderson, Philip Warren, 1967 (13), Room 1D-26B, Bell Telephone Laboratories, Inc., 600 Mountain Avenue, Murray Hill, New Jersey 07974

↑ Deceased since July 1, 1977.
↓ Became an Emeritus Member.

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Dauben, William Garfield, 1970 (14), Department of Chemistry, University of California, Berkeley, California 94720
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Davidson, Norman Ralph, 1960 (21), Department of Chemistry, California Institute of Technology, Pasadena, California 91125
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Davis, Hallowell, 1948 (24), Central Institute for the Deaf, 818 South Euclid, St. Louis, Missouri 63110
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Number of Members Emeriti July 1, 1977: 40

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Reichel-Dolmatoff, Gerardo, 1976 (51), Universidad de los Andes, Bogotá, Colombia
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Ryle, Sir Martin, 1975 (12), Cavendish Laboratory, Madingley Road, Cambridge CB3 OHE, England
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Sanger, Frederick, 1967 (21), Medical Research Council, Laboratory of Molecular Biology, University Postgraduate Medical School, Hills Road, Cambridge CB2 2QH, England
Sela, Michael, 1976 (21), Office of the President, Weizmann Institute of Science, Rehovot, Israel
Semenov, Nikolai Nikolaevich, 1963 (14), Institute of Chemical Physics, Vorobyevskoye chaussee 2, Moscow, V-133, U.S.S.R.
Siegel, Carl Ludwig, 1968 (11), Mathematics Institute, University of Göttingen, 34 Göttingen, Germany
Slattery, Ralph Owen, 1976 (25), Department of Environmental Biology, Australian National University, Canberra, Australia
Sokolov, Eugene Nikolaievich, 1975 (52), Faculty of Psychology, Moscow State University, Moscow, U.S.S.R.
Šorm, František, 1971 (14), Institute of Organic Chemistry and Biochemistry, Czechoslovak Academy of Science, Prague 6, Czechoslovakia
Strömgren, Bengt, 1971 (12), Cph Observatory, Østervoldsgade 3, DK-1350 Copenhagen K, Denmark
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Swings, Pol, 1966 (12), Institut d’Astrophysique, Université de Liège, Cointe-Ougree, Belgium
Szentágothai, János, 1972 (22), 1st Department of Anatomy, Semmelweis University Medical School, Tűzoltó utca 58, 1450 Budapest, Hungary
Takhtajan, Armen Leonovich, 1971 (25), Komarov Botanical Institute, 2 Prof. Popov Street, Leningrad 197022, U.S.S.R.
Tamiya, Hiroshi, 1966 (25), Shinjuku-ku, Shimo-ochi-ai, Tokyo, 3-9-10, Japan (161)
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von Frisch, Karl, 1951 (24), Uber der Klause 10, 8000 Munich 90, Germany
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