Authors

The Biochemical Journal places emphasis on the prompt publication of Full-length Papers (on average about 6 months after receipt), Rapid Papers (on average within 3 months of receipt), Reviews and BJ Letters. It is the Journal's policy to publish papers in English in all fields of biochemistry, provided that they make a sufficient contribution to biochemical knowledge. Papers may include new results obtained experimentally, descriptions of new experimental methods of biochemical importance, or new interpretations of existing results. Theoretical contributions will be considered equally with papers dealing with experimental work. All work presented should have as its aim the development of biochemical concepts rather than the mere recording of facts. Preliminary or inconclusive experiments should not be described.

Papers are accepted from non-members and members of the Biochemical Society. Prospective authors should note that the Biochemical Journal offers rapid publication and makes no manuscript handling charges, no page charges and no charges for plates (except colour). Fifty reprints are provided free of charge; further copies are available at modest cost.

The paragraphs below are a summarized version of information provided in the Biochemical Society's Policy of the Journal and Instructions to Authors [Biochem. J. (1988) 249, 1-20]. Copies are available from the Editorial Office.

The following types of submission are considered by the Editorial Board:
1. Full-length Papers (normally eight printed pages maximum)
2. Rapid Papers (four printed pages maximum)
3. Letters (two printed pages maximum)
4. Reviews (usually solicited)

Full-length Papers and Rapid Papers

Full-length Papers should not normally exceed eight printed pages, including figures and tables. Longer papers may be acceptable if their content justifies their length, but authors should request that shorter papers are generally published with the least delay. All papers that can be accommodated in four pages of the Journal will be treated as Rapid Papers. They receive priority treatment and it is aimed for their publication to be within 3 months of receipt. However, the criteria of reviewing and the appearance of Rapid Papers in the Journal are identical with those of Full-length Papers. In order to achieve the accelerated schedule, reviewers are asked to give priority to the paper and not to accept Rapid Papers that are not supplied to authors. In addition, Rapid Papers that do not contain half-tone figures may be submitted by FAX to the number below. In this case only one copy of the article is required, and acknowledgement of receipt and the review decision will be returned to the author by FAX. Refer to the current Instructions to Authors for details of this procedure.

Papers submitted for publication should be addressed to the Editorial Manager, The Biochemical Journal, 7 Warwick Court, London WC1R 5DP, U.K. (telephone 01-405 4918; FAX 01-831 1853; from overseas the international code for the U.K. is +44 and the initial 0 should be omitted). Three copies of the typescript should be submitted. The typescript should bear the name, address and telephone number (and FAX number if possible) of the person to whom correspondence (including proofs) should be sent. An additional copy of the synopsis should be enclosed. The top copy should be accompanied by the original artwork. Photocopies of line drawings are acceptable for the other two copies but glossy prints (not photocopies) of all the half-tone figures must be provided. It is helpful if the author encloses copies of relevant preceding papers, especially if these were not published in the Biochemical Journal. If reference is made to a paper 'in the press' in another journal the reviewers will not have access to this material and it is essential that the author should include photocopies of the relevant typescript or proofs together with documentary evidence that it has been accepted for publication.

Failure to do this may lead to delay in reviewing. Any reference to a 'personal communication' must be supported by written permission for the quotation from the individual concerned.

Before preparing papers, authors should consult a current issue of the Journal to make themselves familiar with the general format, such as the use of cross-headings, lay-out of tables and citation of references (either the Harvard or the numerical system may be used for these). Typescripts should be in double-spaced typing throughout (including the references and legends of tables and figures) on sheets of uniform size (preferably ISO A4) with wide margins. Output from computer printers must be of 'near letter' quality.

Full-length Papers should not normally exceed 7000 words in length, and Rapid Papers should not exceed 3500 words, each inclusive of title, synopsis and references. Authors must assess what proportion of a page insertions (such as tables, figures and schemes) will occupy and reduce the number of text words accordingly at the rate of 1000 words per full page of the Journal.

Authors should state under which section of the contents list they wish their paper to appear:
Papers
Proteins Enzymes Carbohydrates Lipids Gene structure and expression Synthesis and degradation of macromolecules Intermediary metabolism and metabolic control Bioenergetics and transport Membranes and receptors Cell structure and function Methods

BJ Letters and Reviews

BJ Letters are intended to provide an opportunity to discuss, criticize or expand particular points made in published work, or to present a new hypothesis. They should not be comments on general aspects of the biochemical world, nor should they be used as an alternative to a Rapid Paper. If a letter is polemical in nature, a reply may be solicited from other interested parties before its publication. Letters must not exceed 1500 words, which is approximately the equivalent of two printed pages; one figure, table or scheme may be included. BJ Letters may also be submitted by FAX (see above).

Reviews will usually be solicited, although unsolicited reviews will be considered for publication; however, prospective writers of reviews should first consult the Chairman of the Editorial Board, and should enclose a short (one typed page) synopsis of the area they propose to cover.

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Preliminary pages: The preliminary pages in each issue have been arranged and paginated so that they can be assembled to give a set of volume preliminary pages; pages (i) and (ii) are the volume title pages supplied with part 1 of each volume, pages (iii)-(vi), (vii)-(x) and (xi)-(xiv) are the contents pages from parts 1, 2 and 3 respectively, and pages (xv) and (xvi) are the volume author index supplied in part 3 of each volume.
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Newsletter 1988

NC-IUB and JCBN hope that their Newsletters, designed to inform scientists about the work of the committees, may help the biochemical community. They are intended to call attention to features of recommendations that are recently published or that are in press. Comments on any item in this Newsletter, or any other aspect of biochemical nomenclature, may be sent to any member of the nomenclature committees, or to their secretary, Dr. A. Cornish-Bowden, CNRS–CBM, 31 chemin Joseph-Aiguiier, B.P. 71, F–13402 Marseille Cedex 9, France.


MEMBERSHIP

The current membership of NC-IUB and JCBN is as follows: Dr. H. B. F. Dixon (Chairman of NC-IUB and JCBN; U.K.); Dr. J. R. Bull (JCBN; South Africa); Dr. C. R. Cantor (NC-IUB; U.S.A.); Dr. A. Cornish-Bowden (JCBN; secretary to both committees; France); Dr. C. Liebecq (NC-IUB and JCBN; as representative of the IUB Committee of Editors of Biochemical Journals; Belgium); Dr. J. Reedijk (JCBN; The Netherlands); Dr. N. Sharon (NC-IUB; Israel); Dr. P. Venetianer (NC-IUB and JCBN; Hungary); Dr. J. F. G. Vliegenthart (NC-IUB and JCBN; The Netherlands). In addition the following are associate members: Dr. P. Karlson (NC-IUB; Federal Republic of Germany); Dr. K. Loening (NC-IUB; U.S.A.); Dr. G. P. Moss (JCBN; U.K.); Dr. E. J. Van Lenten (NC-IUB; U.S.A.); Dr. E. C. Webb (NC-IUB; Australia).

Dr. K. Loening (U.S.A.) retired from JCBN at the end of 1985, and Dr. G. P. Moss retired from JCBN at the end of 1986. Dr. J. R. Bull was appointed by IUPAC to fill one of the vacancies created.

ENZYME NOMENCLATURE


Work on a second supplement is progressing and NC-IUB hope that this will be ready for publication towards the end of 1988. NC-IUB plan to issue further supplements as appropriate during the years until the next edition is published so as to keep Enzyme Nomenclature up to date. The 1984 edition was published for IUB by Academic Press Inc., Orlando, Florida, U.S.A. It is still available in both hardback (ISBN 0 12 227162 9) at US$ 45.00 and paperback (ISBN 0 12 227163 7) at US$ 19.50.

NC-IUB are heavily dependent on information supplied by biochemists around the world for preparing new entries and modifying old ones. We take this opportunity to repeat our standing invitation to send comments on Enzyme Nomenclature to Emeritus Professor E. C. Webb, 1/221 King's Road, Mundingburra, Townsville, Queensland, Australia 4812, or to any member of NC-IUB or JCBN. A report form for this purpose, which is not copyright and may be freely copied, may be found inside the back cover of Enzyme Nomenclature. (The address shown at the bottom of this form has, however, been superseded by the one given here.)

As noted in the 1986 Newsletter, it did not prove practicable to include a complete list of site-specific methyltransferases and deoxyribonucleases ('restriction enzymes') in the 1984 edition of Enzyme Nomenclature. Such lists have, however, been prepared by Roberts [1] and by Kessler & Hölte [2]. These lists are updated annually.

BIOCHEMICAL NOMENCLATURE AND RELATED DOCUMENTS

A new edition of the Compendium Biochemical Nomenclature and Related Documents has been prepared by the IUB Committee of Editors of Biochemical Journals. It includes all of the recommendations of NC-IUB, JCBN and their predecessors that are considered to be still current, with any revisions noted, up to about 1986. It is to be published for IUB by the Biochemical Society, 7 Warwick Court, London WC1R 5DP, U.K.

NOMENCLATURE OF PRENOLS

New recommendations on the nomenclature of prenols have now been published [3]. The document sets out to systematize existing nomenclature, supplementing it where appropriate. It pays particular attention to stereochemical aspects of prenols and clarifies the different methods that are in use for describing the number and order of isoprene residues of short-chain prenols and those of polyisoprene (with more than four isoprene units) and dolichols. Particular attention is paid to naturally occurring prenols and their phosphates, and their biosynthetic relationships are summarized in a chart that includes the EC numbers used in Enzyme Nomenclature for the enzymes involved.

Various trivial names, such as geraniol (for trans-diprenol), nerol (cis-diprenol) and farnesol (any of four stereoisomers of triprenil) are in common use, and these are listed and defined. Isoprenoids are the precursors of the terpenoids, which are named as hemiterpenoids, monoterpenoids, sesquiterpenoids, diterpenoids, sesterterpenoids, triterpenoids, tetraterpenoids (also known as carotenoids) according to the number of pairs of isoprene units they contain. Rubber is an all-cis polymer with
many residues, whereas gutta percha is the corresponding all-trans polymer. Other prenol derivatives defined in the document include juvenile hormones and dolichols.

The structures of prenols may be represented compactly by a set of four one-letter symbols in which W represents the ω-residue (furthest from the hydroxyl group), T a trans-residue, C a cis-residue and S a saturated (dihydro) residue. For example, geranylgeranyl dipiphosphate may be symbolized in this system as WTTT-POP.

The recommendations are based on the widespread practices of researchers in the field and JCBN hope that the drawing together of the information into one document will assist the unambiguous description of prenols and their derivatives by both biochemists and chemists.

NOMENCLATURE AND SYMBOLS FOR FOLIC ACID AND RELATED COMPOUNDS

The folates are a group of heterocyclic compounds based on the 4-(pteridin-6-ylmethyl)aminobenzoic acid skeleton conjugated with one or more L-glutamate units. They are the subject of recently published recommendations [4] that revise those prepared in 1964. They seek to alter existing practice as little as possible, but to take account of the great increase in knowledge of the stereochemistry that has occurred during the past 20 years.

The revised recommendations recognize a simpler use of the prefix dihydro- to mean 7,8-dihydro- than was accepted previously, extending the already recognized use of tetrahydro- in the context of folates to mean 5,6,7,8-tetrahydro-, and taking account of the biological importance of the 7,8-dihydrofolates.

All of the known natural stereoisomers have the same configuration at C-6 as (6S)-tetrahydrofolate, with the H on C-6 placed below the plane of the paper when the formula is drawn with the pterin ring system at the left and the benzoic acid group at top right (i.e. arranged so that N-1 is at bottom left and the numbering proceeds clockwise). However, they are variously designated as R or S according to the priority rules in the RS system [5].

In cases where a mixture of diastereoisomers is present, the prefix amb- may be used to indicate this, as recommended for the nomenclature of tocopherols [6] and of amino acids and peptides (see paragraphs 3AA-13.2 and 3AA-19.2 in [7]); this has the advantage over rac- that it does not imply a mixture of enantiomers (with one enantiomer containing residues of L-glutamate) or a mixture in equal proportions of stereoisomers at C-6.

Among the names proposed for common substituents, the name formimino for HN==CH- is recommended as being more in accord with biochemical practice than the systematic names iminomethyl or formimidoyl, which are little used in biochemistry. The substituents methylene (CH2) and methenyl (CH) form bridges between N-5 and N-10 of reduced folates. In the latter case a positive charge is associated with the N-ωCH=ω-N structure, and it is suggested that this can be symbolized as -CH+-, as, for example, in (6R)-5,10-CH+-Hfolate to symbolize (6R)-5,10-methenyltetrahydrofolate.

NOMENCLATURE OF TETRAPYRROLES

Provisional recommendations on the nomenclature of tetrapyrroles were prepared by JCBO in 1978, and were published both in full [8] and in a much shorter report [9] that selected items of primary interest in mammalian biochemistry. These recommendations have been widely adopted and the present revision is based on comments received on the provisional document. In the revised recommendation two new trivial names, isobacteriochlorin and sirohydrochlorin, are defined; the names of linear tetrapyrroles are amended; and the system is extended to dipyrrrole systems. Tables are provided to show the structures of the more commonly encountered compounds using the Fischer system for denoting isomers (the fifteen isomers of mesoporphin defined by Fischer, as well as some isomers of biliverdin). The revised recommendations have now been published [10].

NOMENCLATURE OF GLYCOPROTEINS

The recently published recommendations on the nomenclature of glycoproteins, glycopeptides and peptidoglycans [11] were primarily concerned with the needs of carbohydrate chemists, for whom the naming of the carbohydrate part is the major point. Consequently, neither these recommendations nor those for the naming of peptides generally [7] include advice on the naming of glycopeptides in which both peptide and carbohydrate parts need to be specified.

If a compound consists of ammonia both acylated by a peptide ('peptidylated') and glycosylated, it can be named by taking either the peptide amide or the glycosylamine as the parent compound, according to convention. An example of such a compound might be called N-[d-Met,Pro]jenkaphalinyl-β-p-glucopyranosylamine by taking glucosylamine as the parent compound and adding the peptidyl substituent, or N1,5-(β-D-glucopyranosyl).dtd-Met,Pro]jenkaphalinamidine by taking the peptide amide as the parent compound and adding the glucosyl substituent. In the latter case, the locant N1,5 follows the recommendation in section 3AA-13.4 of the recommendations on amino acids and peptides [7]: it means that the group is attached to atom N-1,5, i.e. the nitrogen atom on C-1 of the fifth residue of the peptide.

CHITOBIOSE

There is ambiguity in the literature as to the identity of chitobiose. Although chitin consists of β1→4-linked N-acetylglucosamine residues, chitobiose contains glucosamine residues instead. This convention derives from the fact that chitobiose was originally [12] isolated from acetolysis of chitin as its octa-acetate, and the name chitobiose was given to the parent disaccharide by analogy with cellobiose, the repeating disaccharide from cellulose. Subsequent investigation of the linkage between the glucosamine residues of chitin [13] led to the convention that chitobiose is a dimer of glucosamine, so that the repeating unit of chitin is the N-acetylated derivative of chitobiose, i.e. N\textsuperscript{N'}-diacetylchitobiose. More precisely, chitobiose is the β(1→4) dimer of glucosamine, symbolized GlcN\textsubscript{N}→4GlcN in the short form recommended in the document on glycoproteins [11], and the corresponding \textit{N}'\textsuperscript{N'}-diacetyl derivative is N-acetyl-D-glucosamine-β(1→4)-N-acetyl-d-glucosamine (GlcN\textacutec{\textae}β\textae4GlcNAc) or \textit{N}'\textsuperscript{N'}-diacetylchitobiose. By analogy, the higher homologue is \textit{NN}'\textsuperscript{N'}-triacetylchitobiose (GlcN\textacutec{\textae}β\textae4GlcNAcβ\textae4GlcNAc).
WHAT IS rDNA?

The increasingly frequent use of the term recombinant DNA in the scientific literature has led to the appearance of the abbreviation rDNA to denote both the technology itself and the DNA molecules that result from it. However, the same abbreviation was pre-empted some time ago to refer to ribosomal DNA, the genes coding for ribosomal RNA. Because rRNA is already a widely used biochemical abbreviation, it is a natural extension to designate rDNA for ribosomal DNA. Thus we would discourage the use of rDNA to refer to recombinant DNA. While alternative abbreviations for recombinant DNA have been suggested [14], it hardly seems necessary to have any standard abbreviation for such a broad class of techniques and molecules.

THE P-450 GENE SUPERFAMILY

The confusion generated by the wide variety of names used during the past two decades has led to the constitution by a group of experts of a Committee on Standardized Nomenclature of the P-450 Genes, which has recently published its recommendations [15,16]. We draw the attention of biochemists to these proposals for information, but would ask that any comments on them should be directed to the corresponding secretary of the committee: Dr. D. W. Nebert, Building 10, Room 6C-101, National Institutes of Health, Bethesda, MD 20892, U.S.A. We also note that NC-IUB referred to the enzymes concerned as heme-thiolate proteins rather than as P-450 proteins or cytochrome P-450 enzymes in the current edition of Enzyme Nomenclature, to avoid the suggestion that they were cytochromes.

REFERENCES

POLICY OF THE JOURNAL AND INSTRUCTIONS TO AUTHORS

Policy and organization of the Journal

It is the policy of the Biochemical Journal to publish papers in English in all fields of biochemistry, provided that they make a sufficient contribution to biochemical knowledge. Papers may include new results obtained experimentally, descriptions of new experimental methods of biochemical importance, or new interpretations of existing results. Theoretical contributions will be considered equally with papers dealing with experimental work. All work presented should have as its aim the development of biochemical concepts rather than the mere recording of facts. Preliminary or inconclusive experiments should not generally be described.

The following items will be included in the Journal.

1. **Full-length Papers**
   These should be written in the style described on pp. 2–3, their length being the minimum required for precision in describing the experiments and clarity in interpreting them. Normally eight printed pages in the Journal is the maximum acceptable length. A concise well-written paper tends to be published more rapidly.

2. **Rapid Papers**
   Any submitted paper occupying not more than four printed pages will be treated as a Rapid Paper. This offers authors the opportunity of publication in a significantly shorter time than the average for full-length papers. The criteria for acceptance are otherwise the same as those for Full-length Papers. Rapid Papers are not regarded as preliminary communications but as complete and final accounts.


4. **Reviews.** See page 3.

   The above statement of policy has been approved by the Committee of the Biochemical Society. The interpretation is in the hands of the Editorial Board, who judge whether each paper submitted is scientifically acceptable.

**Editorial Office**

The Editorial Office, which is part of the Society organization under the general control of the Executive Secretary, is administered by the Editorial Manager. He is concerned with all aspects of the processing, subediting and printing of the Biochemical Society’s publications. The Editorial Manager is responsible to the Chairman of the Editorial Board, who, on behalf of the Editorial Board, takes responsibility for the Journal content. All correspondence concerning the Biochemical Journal should be directed to the Editorial Manager, Biochemical Journal, 7 Warwick Court, London WC1R 5DP, U.K.

**The Editorial Board and the Editorial Advisory Panel**

Members of the Editorial Board, which is international, are appointed by the Committee of the Biochemical Society on the recommendation of the Editorial Board. The composition of the Board is such that there is a wide range of expert opinion covering most areas of biochemical research.

The Editors are supported by an international panel of some 300 Editorial Advisers. These are independent reviewers, who are expert each in their own specific field of biochemistry, and who review up to ten papers a year for the Journal. The close association of the Advisers with the Journal means that a high standard of reviewing can be maintained.

Editors normally serve for a period of 5 years, although this may be extended for a further 2 years in some cases. The composition of the Advisory Panel is reviewed each year.

The names of the members of the Editorial Board are published in each issue of the Journal; those of the members of the Advisory Panel also appear from time to time.

**Handling of papers**

Three copies of papers are required by the Journal (but see below). One copy is retained for reference by the Editorial Office, the second is sent to a selected Adviser (or, rarely, to another independent reviewer) and the third is sent simultaneously to a relevant Editor. The Adviser (or other reviewer) assesses the paper and sends the report to the Editor by a date stipulated by the Editorial Office. The Editor will, in the meantime, have reached an independent judgement and, on receipt of the report, compiles a combined editorial report based on both opinions. In some cases, Editors will seek further advice from other scientists, and the report then reflects the views of all consulted. If the Editor and Adviser disagree, even after direct discussion, a second Editor is asked for an opinion and, if need be, a further Adviser. This will also be done not infrequently when review of a paper demands expertise in more than one field of biochemistry. All papers are therefore seen by at least two independent scientists, and often by more. The time taken for review is monitored by the Editorial Office, so that the policy of the Journal to give authors rapid decisions is sustained.

When a paper is judged to have scientific merit and thus to be basically acceptable, the Editorial Office sends an appropriate letter to the authors together with any editorial report containing comments for the authors’ consideration. After revision by the author the paper is checked by an Editor before being finally prepared for press by the subeditors.

If a paper is to be declined, the reports and correspondence are seen by the Chairman or one of the Deputy Chairmen, who then writes an explanatory letter to the authors.

Papers may be declined for several reasons. They may, in the opinion of the reviewers, be unsatisfactory scientifically in that the methodology is open to criticism or that the conclusions are not sufficiently supported by the evidence presented. They may contain material that
Instructions to authors

Submission of papers

Submission of a paper to the Biochemical Journal implies that it has been approved by all the named authors, that it reports unpublished work, that it is not under consideration for publication elsewhere, and that if accepted for the Journal it will not be published elsewhere in the same form, either in English or in any other language, without the consent of the Biochemical Society. In order to protect the copyright of the authors and the Society, the Society will request authors to assign copyright to the Society at the time of a paper's acceptance for publication.

The inclusion in a paper of material that has been wholly or largely published elsewhere will not be acceptable, even when publication has taken place in symposium proceedings, etc., that are not subjected to a review process. This applies to tables and figures particularly.

Papers on specialized subjects should be intelligible to the ordinary reader of the Journal. Sufficient information must be included to permit repetition of the experimental work.

Papers that are scientifically acceptable but need revision because they are not clear or concise or do not conform sufficiently to the conventions of the Biochemical Journal will be returned to the authors for amendment. If a paper is not resubmitted within 3 months it will be treated as a new paper and the date of receipt will be altered to the date of resubmission. In all cases the decision of the Chairman of the Editorial Board will be final.

The following types of papers appear in the Journal.

1. **Full-length Papers** (normally eight printed pages maximum).
2. **Rapid Papers** (four printed pages maximum).
3. **Letters** (two printed pages maximum).
4. **Reviews** (usually solicited).

Full-length Papers and Rapid Papers

Three copies of the typescript should be sent to the Editorial Manager, The Biochemical Journal, 7 Warwick Court, London WC1R 5DP, U.K. [telephone +44 (from outside the U.K.) or 01 (inside the U.K.) 405-4918]. The typescript should bear the name, address and telephone number of the person to whom correspondence (including proofs) should be sent. An additional copy of the synopsis should be enclosed to facilitate selection of reviewers. The top copy should be accompanied by the original artwork (see p. 6 for advice on the preparation of figures). Photocopies of line drawings are acceptable for the other two copies but glossy prints (not photocopies) of all the half-tone figures must be provided. Two copies will be sent simultaneously to two reviewers. The third copy will be held in the Editorial Office to be used in case of loss or if an additional reviewer is required.

Authors should state under which section in the contents list their papers should appear:

- **Proteins**
- **Enzymes**
- **Carbohydrates**
- **Lipids**
- **Gene structure and expression**
- **Synthesis and degradation of macromolecules**
- **Intermediary metabolism and metabolic control**
- **Bioenergetics and transport**
- **Membranes and receptors**
- **Cell structure and function**
- **Methods**

The main way in which authors can contribute to shortening the time between receipt of a paper and its publication date is to follow the requirements and suggestions in these Instructions to Authors, and to write in a concise style. In the Board's view, most Full-length Papers should not normally exceed eight printed pages, including figures and tables (see below). Longer papers may be acceptable if their content justifies their length. Indeed, the Board's desire to restrict the length of papers should not lead authors to split their work into two or more shorter papers. For example, a single paper consisting justifiably of ten printed pages will normally be considered more favourably than two papers each of six pages dealing with the same material. Authors should remember that short papers are generally published with the least delay.

Papers that can be accommodated in four pages of the Journal will be treated as Rapid Papers. They receive priority treatment and it is aimed for their publication to
be within 3 months of receipt. However, the criteria of reviewing and the appearance of Rapid Papers in the Journal are identical with those of Full-length Papers. In order to achieve the accelerated schedule, reviewers are asked to give priority to the paper and proofs of accepted Rapid Papers are not normally supplied to authors. However, authors are given details of any editing of Rapid Papers at the same time that the typescripts are sent to the printer, with a request that any essential amendments be sent to the Editorial Manager as soon as possible. The scientific editorial staff in the Editorial Office check the proofs to ensure that they tally exactly with the edited typescripts and make any necessary alterations indicated by the authors.

'To accelerate handling of Rapid Papers, particularly from outside the U.K., they may be submitted by FAX and, for such papers only, acknowledgement of receipt and the review decision will be transmitted to authors by FAX. The criteria for submission by FAX are: (i) that the paper meets the length requirement for a Rapid Paper (see below), (ii) that the whole submission (covering letter, double-spaced text, tables and figures and their legends, and any supporting material) should not exceed 20 pages of A4 paper, and (iii) that, because of the technical limitations of FAX transmission and the requirement (see above) that original prints of half-tone illustrations should be provided for the reviewers, the paper does not contain such half-tones. Original artwork of papers submitted by FAX should be retained by authors until they receive acknowledgement of receipt; it should then be sent to the Editorial Office by post or courier, quoting the manuscript reference number. If a FAX-submitted paper is rejected, a copy of the decision letter and the artwork will be returned to the authors by post. Authors submitting by FAX need transmit only one copy of their paper; they should also be sure to include a FAX response number in their covering letter. The number for submission by FAX is +441 (from outside the U.K.) or 01 (inside the U.K.) 831-1853.

Before preparing papers, authors should consult a current issue of the Journal to make themselves familiar with the general format, such as the use of cross-headings, lay-out of tables and citation of references. Typescripts must be in double-spaced typing throughout (including the references and legends of tables and figures) on sheets of uniform size (preferably ISO A4) with wide margins. Typescripts produced on low-quality dot-matrix printers may not be of an acceptable standard, particularly with respect to the superscripts and subscripts often found in scientific work.

It is helpful if authors enclose copies of relevant preceding papers, especially if these were not published in the Biochemical Journal. If the paper submitted refers to a paper 'in the press' in another journal the reviewers will not have access to this material and it is essential that authors should include photocopies of the relevant typescript together with documentary evidence that it has been accepted for publication. Failure to do this may lead to delays in reviewing. Any reference to a 'personal communication' must be supported by documentary evidence from the individual quoted showing that agreement with the quotation is given.

The full title should be concise but informative enough for use in coding for information storage and retrieval. Papers should also be headed by the authors' names (preferably with one forename in full for each author, other forenames being given as initials) and by the name and address of the establishment where the work was done. A running (page-heading) title of up to 60 characters should also be given.

Separate papers in a series may not be numbered, but subtitles may be used if they are particularly necessary.

The synopsis, which can be in numbered sections, should be of less than 250 words (60 words for Rapid Papers) and normally only 3-4% of the length of the paper. It should be as informative as possible for abstracting journals or 'fringe' readers but should not contain inessential details or material not described in the body of the paper.

The main body of the paper may be divided into (a) the Introduction; (b) Experimental, including materials and methods; (c) Results; (d) Discussion; (e) acknowledgements, including details of financial support; (f) References. It is often an advantage to combine (b) and (c) (e.g. in papers describing techniques) or (c) and (d) with gains of conciseness and clarity. In chemical papers, the Experimental section may be placed after the Discussion. The Discussion section should not recapitulate the Results, but only discuss their implications.

Full-length Papers should not normally exceed 7000 words in length, and Rapid Papers must not exceed 3500 words, each inclusive of title, synopsis and references. Authors must assess by reference to a recent copy of the Journal what proportion of their paper will be occupied by insertions such as tables, figures and schemes and should reduce the number of text words accordingly at the rate of 1100 words per full page of the Journal. A quick method of estimating the printed length of typescripts is to add the number of pages (including references, but not figure or table legends) to the number of figures and tables and divide the total by three. This assumes double-spaced typing on A4 paper with normal margins.

BJ Letters

'BJ Letters' are intended to provide an opportunity to discuss, criticize or expand particular points made in published work, or to present a new hypothesis. They should not be comments on general aspects of the biochemical world, nor should they be used as an alternative to a Rapid Paper. If a letter is polemical in nature, a reply may be solicited from other interested parties before its publication.

Typescripts should be submitted in triplicate, written in English using the spellings and abbreviations that are approved by the Journal. No synopsis is required. BJ Letters must not exceed 1500 words in length, which is approximately the equivalent of two printed pages. One scheme, table or figure may be included. To minimize delay in publication, accepted Letters are treated in the same way as Rapid Papers. Contributions that are not being published will be returned to the authors with minimal delay.

BJ Letters may also be submitted by FAX (see above).

Reviews

Biochemical Journal Reviews will usually be solicited, although unsolicited reviews will be considered for publication. Prospective writers of reviews should first consult the Chairman of the Editorial Board, and should enclose a short (one typed page) synopsis of the area they propose to cover.
Reprints, permissions and subscriptions

All communications about reprints should be addressed to the Reprint Department, The Biochemical Society, 7 Warwick Court, London WC1R 5DP, U.K.

Requests for consent for reproduction of material should be addressed to the Editorial Manager at the above address.

All communications about subscriptions to the Journal should be addressed to the Biochemical Society Book Depot, P.O. Box 32, Commerce Way, Colchester CO2 8HP, U.K.

Notes on the preparation of papers

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For nomenclature please refer to the separate section on pp. 10–15, or, for specialized problems, the relevant documents listed there.


Authors are encouraged to employ their own style, although papers must be concise and should conform to normal English usage.

The following items in the present section are listed in alphabetical order.

Acknowledgements

These must be as short as possible.

Animals

The full binominal Latin names should be included for all experimental animals other than common laboratory animals. The strain, and if possible the source, of laboratory animals should be stated. The source, and if possible the composition, of the diet of laboratory animals should be specified; this is particularly important in papers reporting the effects of dietary manipulation.

Centrifuging

When conditions for centrifuging are critical, sufficient information should be given for the procedure to be repeated. The quantitative composition of the suspension medium should be stated. The centrifuge rotor should be unambiguously identified and the temperature of operation stated.

The time of operation of the rotor at sustained plateau speed (ignoring initial rotor acceleration and deceleration periods) should be stated. The centrifugal field should be stated in multiples of g (as defined on p. 17), based on the average radius of rotation of the liquid. For example; ‘The rotor was operated for 15 min at 2°C and 10 000 g (ra.v., 8 cm)’.

Alternatively, when it is necessary to take into account periods of acceleration and deceleration of the rotor, the rotor speed (ω in rad/s) and time of operation should be integrated and the total integrated field-time stated (as multiples of g) for the average radius of rotation (ra,v.) of the column of liquid in the rotor. For example; ‘The rotor was operated at 5°C. The integrated field-time was 250 000 g·min at ra,v. 6.5 cm’ [i.e. (ra,v./g) ∫ ω dt = 250 000 (at ra,v. 6.5 cm)].

Density-gradient centrifugation. The make of centrifuge and rotor used, the temperature of the run and the composition of the gradients should be stated. Results should preferably be plotted against distance from rotor centre rather than against fraction numbers; it is then unnecessary to indicate top and bottom of the gradient. If fraction numbers are used, the top and bottom of the gradient should be indicated.

Ultracentrifuge data. Sedimentation coefficient (not constant), s; sedimentation coefficient corrected at 20°C in water, s20,w; sedimentation coefficient at zero concentration, s0,w; Svedberg unit (10−13 s); S; partial specific volume, ervice; diffusion coefficient, D, Dp, D20,w, etc. as for sedimentation coefficient. The temperature at which the sedimentation and diffusion measurements are made should be stated.

Chromatography

Photographs or drawings of paper or thin-layer chromatograms are not generally published unless they convey information, such as a demonstration of homogeneity, that is not readily established in the text.
Densitometric records of chromatograms are always preferable.

The rate of movement of a substance relative to the solvent front in paper or thin-layer chromatography is best expressed as its $R_F$ value, or, if relative to a reference compound, by its $R_{compound}$ value. Solvents should be described in the form butan-1-ol/acetic acid/water (4:4:1, by vol.) or butan-1-ol/acetic acid (4:1, v/v).

Elution diagrams for chromatographic columns should be shown with the effluent volume increasing from left to right. Units of concentration and volume must be shown clearly.

Column (i.e. bed) dimensions should always be quoted, and where possible column void volumes ($V_0$) should be given. Elution zone maxima may be characterized by elution volumes ($V_e$) or preferably by partition coefficients ($\alpha$ or $K_D$). The course of any eluent gradients used should be indicated clearly.

Computer programs

If the use of a computer program forms a significant and essential part of the work described in a paper, the program must be adequately documented, if not in the paper itself, then by reference to a previously published original source, or by deposition of the program listing with a suitable depository (it should be noted, however, that the Editorial Board cannot accept the responsibility of checking the accuracy of such deposited programs).

Deposition of data

Information (computer programs, evidence for amino acid sequences, spectra, etc.) supplementing papers in the Biochemical Journal may be deposited free of charge with the British Library Lending Division, Boston Spa, Wetherby, West Yorkshire LS23 7BQ, U.K., where it will be stored in its original form. The supplementary material must in the first instance be sent to the Journal with the parent paper, and not direct to the B.L.L.D. It may be subject to editing in the normal manner before being accepted for deposition and the authors will then be responsible for preparing camera-ready copy according to the following specifications.

(a) Limiting page size for text or tables in typescript: 33 cm x 24 cm.

(b) Limiting size for diagrams, graphs, spectra, etc.: 39 cm x 28.5 cm.

(c) Tabular matter should be headed descriptively on the first page, with column headings recurring on each page.

(d) Pages should be clearly numbered to ensure correct sequence.

It is suggested that some prefatory text should be included, such as the author's synopsis from the parent paper.

The Editorial Office will be responsible for depositing the material with the B.L.L.D. at this stage.

This supplementary information will be available as full-size copies from the Library's photocopying services, which work on a pre-paid flat-rate coupon basis, details of which can be obtained from the B.L.L.D. (address above). The Supplementary Publication number given in the paper in question should be quoted when the item is ordered.

A memorandum on the preparation of material for data deposition is available from the Biochemical Journal Editorial Office on request.

Dialysis

The terms 'diffusate' and 'non-diffusible material' (or 'dialysis residue') should be used. 'Dialysate' should not be used.

Electrophoresis

Photographs or drawings of electrophoretic separations on paper or cellulose acetate will be published only if they convey information, such as a demonstration of homogeneity, that is not readily established in the text.

Photographs of electrophoretic separations in gels such as starch or polyacrylamide may be published if they convey essential information, but, as reproduction may not always be satisfactory, line drawings may be more informative. Densitometric records are usually superior.

Electrophoretic mobilities ($m$) and the composition of the electrophoretic medium, pH and temperature should be quoted. The operative voltage gradient should be specified where possible.

The symbol pI should be used for isoelectric point.

Enzymes


Enzyme units. Units of the amount of enzyme should be defined in each paper, and this may be done in terms of the rate of reaction catalysed under conditions specified. The SI unit for the rate is 1 mol of substrate transformed/s (or, if necessary, 1 mol of measured product formed/s), and this gives the unit of the amount of enzyme that has been given the name of katal (symbol: kat) [see Eur. J. Biochem. 97, 319–320 (1979), corrected in Eur. J. Biochem. 104, 1 (1980)]. Units of the amount of enzyme may, however, be expressed in terms of the amount that can catalyse other rates, e.g. 1 $\mu$mol of substrate transformed/min.

Standard protein solutions. When standard proteins such as bovine serum albumin are used as a basis for the determination of other protein concentrations, the type of protein, its source of supply and the moisture content (if appropriate) should be given.

Kinetic constants. Velocity constants for the forward and the backward reactions in the $n$th step of an enzymic reaction should be represented by $k_n$ and $k_{-n}$ respectively. The Michaelis constant is defined as $K_m = [S]$ when $v = V/2$, where $v$ is the velocity of appearance of product or disappearance of substrate at a given substrate concentration [S] and $V$ is the velocity when the enzyme is saturated with the substrate. When reactions with two substrates A and B are being considered $K_{m}^A = [A]$ when $v = V/2$ and $[B]$ has been extrapolated to infinity; a value for $[A]$ when $v = V/2$ at a finite concentration (which must be specified) of B should be referred to as an apparent $K_m^A$. $K_s$ is the equilibrium constant of the dissociation of the substrate–enzyme complex.
Ethics of animal experimentation

Experiments with animals should be performed in accordance with the legal requirements of the relevant local or national authority. Procedures should be such that experimental animals do not suffer unnecessarily. The text of papers should include experimental details of the procedures and of anaesthetics used. The Editorial Board will not accept papers where the ethical aspects are, in the Board’s opinion, open to doubt.

Information and advice about experiments involving animals are to be found in Guidelines on the Use of Living Animals in Scientific Investigations (1984), ISBN 0 9500213 1 8, obtainable from The Biological Council, c/o Institute of Biology, 20 Queensberry Place, London SW1 2DZ, U.K., price £1.50, post free.

Ethics of human experimentation

The Editorial Board agrees with the recommendations in the Report of the Medical Research Council for 1962–63 [Br. Med. J. (1964) ii, 178–180]. Authors should ensure that their work complies with these recommendations. A paper describing any experimental work with humans should include a statement that the Ethical Committee of the Institution in which the work was performed has approved it, and should state that the subjects have given informed consent to the work.

Ethics of scientific publication

Authors may like to refer to the ‘Ethical Guidelines to Publication of Chemical Research’ formulated by the American Chemical Society [see Biochemistry (1986) 25, 9A–10A].

Experimental hazards

Authors should draw attention to any particular chemical or biological hazards that may be involved in carrying out the experiments described. It may be appropriate to describe relevant safety precautions taken for any hazard, or to include a statement that an accepted code of practice has been followed. In the latter case a reference to the relevant standards should be given.

Footnotes

These should be avoided as far as possible. Where they must be used, as in tables, reference is made by the symbols * † ‡ § ¶ ‍, in that order.

Illustrations

Each illustration should be on a separate sheet and packed flat; each should bear the author’s name, the title (abbreviated if necessary) of the paper and the figure number on the back. Its approximate position should be indicated in the margin of the typescript. Illustrations constitute an expensive item of publication and may increase the time taken in printing. Their number should be kept to a minimum.

Headings and legends. Each illustration should be supplied with an informative heading and an explanatory legend, starting on a new line and typed double-spaced. The heading and legend should make the general meaning comprehensible without reference to the text. Conditions specific to a particular experiment should be stated. Reference to the text for general experimental details is permissible provided there is no ambiguity.

Line diagrams. Artwork should be supplied in a form (apart from lettering, which can be in ink or pencil) that can be reproduced directly by the printer. It is therefore essential for authors to adhere to the following instructions with regard to the preparation of line drawings for figures; otherwise their illustrations will have to be returned to them or redrawn by the printer’s draughtsman, with consequent delay or expense.

Diagrams should be in black ink on white paper or card; if graph paper is used it must have pale blue guide lines. A line thickness obtained with a 0.4 mm Rotring pen (or equivalent) is desirable. All curves, lines and symbols should be drawn clearly, and of a line thickness and size that allows for a 40–50% reduction in size on final printing. Axes should not extend appreciably beyond the curves, and it is often unnecessary for an axis scale to start at 0; only the part of the scale relevant to the curves should be given.

The preferred symbols for experimental points are O, □, △, ●, ■, ▲; × and + should be avoided. The same symbols must not be used on two curves where the points might be confused; subject to that limitation, however, the same symbols should, if possible, be used for the same entities throughout a paper. Individual curves may also be distinguished by distinctive line forms (e.g. — — and ———) or by single-letter labels or by brief explanatory labels (see below).

Illustrations for reproduction are reduced photographically and their width should not exceed 16 cm (for illustrations intended to be single-column width) or 33 cm (for illustrations intended to be double-column width). A margin of at least 3 cm is essential.

Final lettering on figures will be done by the printer. It is therefore sufficient for authors to insert clear guide lettering in soft pencil on a photocopy of the figure. The addition of carefully drawn lettering in black ink is not necessary but is permissible.

Authors are encouraged to use brief explanatory labels within a figure if it is thereby more readily understood and if the labels can be inserted without requiring a larger figure. The final lettering of such labels will, again, be done by the printer.

Histograms. Simple histograms recording only a few values should not be used. The information can be given more concisely as a table or as a sentence or two in the text.

Sequence diagrams. Amino acid and nucleotide sequences are often printed in a form that requires careful vertical alignment. Authors should submit such sequence diagrams in camera-ready form, thereby avoiding the misalignments that can be introduced by typesetting and obviating the need for proof-reading of large arrays of complex information. Such diagrams should be prepared with an electric typewriter or ‘letter-quality’ computer printer with a carbon-film ribbon; any additional markings should be added carefully in black ink.

Half-tone illustrations (photographs). Half-tone illustrations will normally be reproduced on text paper. Glossy prints are required, and it is helpful if the prints
supplied are trimmed to the intended reproduction size (i.e. to fit within the page area). Where the magnification is to be indicated (e.g. on electron micrographs), this should be done by adding a bar representing a stated length.

If it is not possible to obtain photographs of the required quality, half-tone illustrations can often be replaced by tracings for reproduction as line diagrams.

**Colour plates.** These are accepted when, in the opinion of the Editorial Board, they are essential to illustrate a particular scientific point. Authors will normally be required to pay the full cost of such plates.

**Isotope experiments**

Where possible, radioactivity should be expressed in absolute terms, i.e. curies (Ci) or becquerels (Bq; disintegrations/s).

**Mass spectrometry**

Full mass spectra are often not published, but the editors may wish to see these. If deemed necessary, full spectra may be deposited with the British Library Lending Division (see the Deposition of Data section on p. 5).

Spectra may be described as, e.g. 'm/z 300 [M* (the molecular ion)], 282 (M* - H2O) etc.' If parenthetic values are quoted for percentage peak heights, it should be stated what these are relative to.

**Micro-organisms**

In the title, in the synopsis and at the first mention in the text, micro-organisms should be given their full binominal Latin name, underlined. Each organism should preferably have been obtained from or deposited with a recognized collection of micro-organisms, and the collection number must be given. Alternatively, a strain number or name should be quoted; this should not be underlined. Names of ranks higher than genus (e.g. Eubacteria, Lactobacillales), generic names used adjectively (e.g. 'staphyloccal') and names of micro-organisms used colloquially (e.g. as in 'most lactobacilli behave thus') should not be underlined. The first (i.e. generic) name should be spelt with a capital letter. Elsewhere in the text, single-letter abbreviations may be given for the generic name; if two genera with the same initial letter are studied, abbreviations such as *Strep.* and *Staph.* may be used.

If the author selects for stated reasons a name that does not conform to that chosen in the most recent edition of one of the reference books quoted below, the name given in the reference book should be added in parentheses after the first mention of the organism in the synopsis, and also in the text. Characteristics of the organism that are known to differ from those quoted in the reference book should also be given, since they are essential for subsequent interpretation of the work.

Great care is needed in verifying the identities of micro-organisms, and authors should bear in mind that the value of their work may be limited if material is wrongly named. Many major culture collections of micro-organisms are able to verify identifications. Authors are urged to deposit new organisms in pertinent culture collections so that they may be readily available to other workers.

**Recommendations on nomenclature in bacterial genetics** have been proposed by M. Demerec, E. A. Adelberg, A. J. Clark & P. E. Hartman [(1966) Genetics 54, 61-76]. Authors should follow these guide-lines wherever appropriate.

The following reference books may be found useful.


**Nucleotide sequences**

Authors should note that nucleotide sequences should be fully determined in both senses of the DNA. An explicit statement to this effect and a supporting diagram summarizing the sequence data would normally be sufficient evidence.

Authors of papers containing primary nucleotide sequence data are asked to send their data to the European Molecular Biology Laboratory Sequence Data Library (EMBL) and, to enable readers to locate in the database the sequence(s) presented in a particular paper, the database accession number will be included in the published paper. On acceptance of a paper containing such data, the Editorial Office will allot a unique accession number in the form of a footnote to the paper, and will at the same time send to the authors a data request form labelled with the same number. The authors should then return the completed data request form, together with the sequence data in computer-readable format or as computer printout, direct to EMBL.

**Plants**

The full binominal Latin names should be included for all plant species. Where appropriate, the variety and the source should be specified.

**Powers in tables and figures**

Care is needed where powers are used in table headings and in figures in order to avoid numbers with too many digits. The quantity expressed is to be preceded by the power of 10 by which its value has been multiplied. The units in which the quantity is expressed may not be multiplied by a power of 10; the unit may be changed by the use of prefixes, e.g. m, µ, n or p. For example: (i) an entry '2' under heading 10^2 k means that the value of k is 0.002; an entry '2' under heading 10^{-3} k means that the value of k is 2000; (ii) a concentration 0.00015 M may be expressed as 0.15 under heading 'concn. (mM)' or as 150 under heading 'concn. (µM)' or 15 under heading '10^4 x concn. (m)' but not as 15 under heading 'concn. (M x 10^{-9})'; (iii) complex quantities are treated similarly; a value for 1/[S] of 200 m^{-1} would appear as '2' under the heading 10^2/[S] (m^{-1}) or as '0.2' under the heading 1/[S] (mM^{-1}). Square brackets may conventionally be used to indicate concentration.
Prefixes for multiples and submultiples of units

These should be as follows:

<table>
<thead>
<tr>
<th>Multiple</th>
<th>Prefix</th>
<th>Symbol</th>
<th>Multiple</th>
<th>Prefix</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10^{12}$</td>
<td>tera</td>
<td>T</td>
<td>$10^{-2}$</td>
<td>centi</td>
<td>c</td>
</tr>
<tr>
<td>$10^9$</td>
<td>giga</td>
<td>G</td>
<td>$10^{-6}$</td>
<td>milli</td>
<td>m</td>
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<tr>
<td>$10^6$</td>
<td>mega</td>
<td>M</td>
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<td>micro</td>
<td>µ</td>
</tr>
<tr>
<td>$10^3$</td>
<td>kilo</td>
<td>k</td>
<td>$10^{-12}$</td>
<td>nano</td>
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<tr>
<td>$10^2$</td>
<td>hecto</td>
<td>h</td>
<td>$10^{-15}$</td>
<td>pico</td>
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<td>atto</td>
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</tr>
</tbody>
</table>

* To be avoided where possible (except for cm).

A combination of a prefix and a symbol for a unit is regarded as a single symbol, which may be raised to a power without the use of parentheses or brackets, e.g. mm$^{-1}$ and cm$^2$.

References

The Harvard System or the Numbering System may be used for the citation of references in the text.

Harvard System. References should appear as follows: for papers written by one or more authors, as 'Trop & Birk (1970)' or ('Harrison, 1971'); for papers written by three or more authors, as 'Davies et al. (1971)' or 'Mayer et al., 1970'. Where more than one paper by the same author(s) has appeared in one year the references should be given as 'Lowe & Yuthavong (1971a,b)' or 'Slater & Sawyer, 1969, 1971a,b,c'.

At the end of the paper references should be listed in alphabetical order, except for papers by three or more authors (which are given in the text only as 'et al.'), which should be grouped in chronological order after any other papers by the first author. The authors' initials should be included, but not the title of the paper. The style to be used is shown in the following examples.


Numbering system. References should be cited in the text by sequential numbers in square brackets, e.g. '[1]', '[2–6]', '[4,5,7–10]' etc. At the end of the paper references should be listed in numerical order in the same style as described for the Harvard system, preceded by the number. Thus:

3. Krebs...

Both systems. First and last pages should be cited for all references. Titles of journals should be abbreviated in accordance with the Chemical Abstracts Service Source Index (1907–1984 Cumulative) (1984) and subsequent Quarterly Supplements (American Chemical Society).

References to books and monographs should be in accordance with the following examples.


References to a paper 'in the press' are permissible, provided that it has been accepted for publication, thus:


References to 'personal communication' and 'unpublished work' are permitted in the text only, i.e. not in the list of references; editors will require to see documentary evidence for the former citation. The use of 'in preparation', 'private communication' and 'submitted for publication' is not allowed.

The above requirements are in accordance with the recommendations of the Commission of Editors of Biochemical Journals [see Biochem. J. (1973) 135, 1–3].

Solutions

Solutions should be described in terms of molarity (M) not normality (N). Fractional concentrations should be expressed in the decimal system, e.g. 0.25 M-HCl (not M/4 HCl). The term % must be defined as w/w, w/v or v/v, e.g. 5% (w/v) means 5 g/100 ml. For aqueous solutions of concentration less than 1%, w/v need not be inserted if it is clear that the concentration is stated in terms of weight of solute. For solutions of salts expressed as % it must be made clear whether anhydrous or hydrated compounds are used. It may be noted that SI recommends that the symbol 'M' should be replaced by 'mol/l', and that % (w/v) and % (v/v) should be given in terms of, e.g., g/l and ml/l. For the time being at least, however, the use of 'M', % (w/v) and % (v/v) will continue to be accepted in the Biochemical Journal.

Buffers. These must be specified so that readers can reproduce the conditions used by authors. It is often useful to give the complete composition of each solution, e.g. '0.09 M-sodium acetate/0.01 M-acetic acid, pH 5.6' (which means that a single solution has these concentrations of these substances) at the first mention or in the Experimental section. A short designation, e.g. '0.1 M-sodium acetate buffer, pH 5.6', may be used elsewhere throughout the paper. In such designations the concentration specified should be the sum of the concentrations of all forms of the partly ionized species. If a buffer contains two or more partly ionized species (e.g. pyridine and acetic acid) then the concentration of each substance included should be stated.

Other forms of specification are permissible, provided that they enable readers to repeat the procedures. Thus buffers may be specified by reference or by adjustment to a certain pH. The description '0.1 M-sodium acetate buffer, pH 5.6' used above is adequate, since it means that the sum of the final concentrations of acetic acid and sodium acetate is 0.1 M. For buffers made by adjustment of pH, the temperature and approximate concentration of the solution at which the pH is adjusted must be specified if either differs from that at which the buffer is used, e.g. 'Approx. 0.2 M-KH$_2$PO$_4$ was adjusted to pH 7.4 with NaOH solution and diluted to 0.1 M'. If the temperature of adjustment differs from room temperature, then the procedure must be described in detail, stating, for example, whether only the glass electrode or both it
and the reference electrode are at the changed temperature.

An initial capital letter should be used for the trivial names of the following buffers, which need not be defined:

Aces 2-[(2-Amino-2-oxoethyl)amino]ethanesulfonic acid
Ada  [(Carbamoylmethyl)imino]diacetic acid
Bes  2-[(Bis-(2-hydroxyethyl)amino]ethanesulfonic acid
Bicine NN-Bis-(2-hydroxyethyl)glycine
Bistris 2-[(2-hydroxyethyl)amino]-2-(hydroxymethyl)propane-1,3-diol
Hepes 4-(2-Hydroxyethyl)-1-piperazineethanesulfonic acid
Hepps 4-(2-Hydroxyethyl)-1-piperazinepropanesulfonic acid
Mes  4-Morpholineethanesulfonic acid
Mops 4-Morpholinopropanesulfonic acid
Pipes 1,4-Piperazinediethanesulfonic acid
Taps 3-[[2-Hydroxy-1,1-bis(hydroxymethyl)ethyl]amino]-1-propanesulfonic acid
Tes  2-[(2-Hydroxy-1,1-bis(hydroxymethyl)ethyl]amino]ethanesulfonic acid
Tricine N-[2-Hydroxy-1,1-bis(hydroxymethyl)ethyl]glycine
Tris  2-Amino-2-hydroxymethylpropane-1,3-diol

Incubation media such as Krebs–Ringer solution, Eagle's medium, Waymouth's medium etc. should be defined either by reference or by giving the composition.

The symbol for ionic strength (mol/l) is I.

Spectra and spectroscopic data

Full spectra should be published when important or novel features are demonstrated; however, other spectra or spectral information may be deposited with the British Library Lending Division (see the Deposition of Data section on p. 5).

The spectra for u.v. and visible absorption, fluorescence, circular dichroism and optical rotation should have a wavelength scale (e.g. nm or μm) whether or not a wavenumber scale (e.g. cm⁻¹) is given. Where possible, molar terms should be used in absorption, circular dichroism and optical rotation. C.d., n.m.r. (use when nuclei other than ¹H are used), p.m.r., e.s.r. or e.p.r. and o.r.d. are acceptable abbreviations and need not be defined.

Visible- and ultraviolet-absorption spectroscopy. Absorbance [log (I₀/I)] should be used, and not extinction or optical density [see IUPAC Manual of Symbols and Terminology for Physicochemical Quantities and Units (1979) Pergamon, Oxford]. Symbols used are: A, absorbance; a, specific absorption coefficient (litre·g⁻¹·cm⁻¹) (alternatively use A₁₀₀₀; ε, molar absorption coefficient (numerically equal to the absorbance of a 1 mol/litre solution in a 1 cm light-path) (use units of litre·mol⁻¹·cm⁻¹ or M⁻¹·cm⁻¹ and not cm⁻¹·mol⁻¹). Wavelengths are given in nm (as subscripts without units, e.g. A₁₁₂₅). No equals sign need be given between ε or A and its value.

Infrared spectroscopy. Spectra are reported as percentage transmittance, T, as a function of wavelength (given in μm) or frequency (given in cm⁻¹). When assigning bands the units need be given for the first value only and the description should be in the style, e.g., 'broad NH band'.

Optical rotation. This is reported as the specific rotation, [α]₀, which is numerically equal to the rotation in degrees of a 1 g/ml solution with a pathlength of 1 dm (10 cm) at wavelength λ and temperature t. The concentration (g/100 ml) and solvent are quoted, e.g. ' [α]₂₅° = -27.5° (c 2 in methanol)'.

The corresponding molar expressions for the molar rotation, [M] = [α] x M, and [m] = [α] x Mᵣ/100, should be defined.

For biopolymers the mean residue Mᵣ is used, and [m] is the mean residue rotation. Where a refractive-index correction is applied, [mᵣ], the reduced mean residue rotation, is reported. Dimensions of [m] and [mᵣ] are degrees·cm²·dmol⁻¹.

Optical rotatory dispersion is reported as the variation of [α] or [m] with wavelength (or frequency).

Circular dichroism. This is reported as the molar circular-dichroism absorption coefficient Δε = ε₁ − ε₀ [or the molar ellipticity, [θ] (see below)]. For biopolymers, molar concentrations in terms of the mean residue Mᵣ are generally used. Units of Δε are the same as for ε, i.e. litre·mol⁻¹·cm⁻¹ or M⁻¹·cm⁻¹.

Specific ellipticity [ψ], molar ellipticity [θ] or mean residue ellipticity [θ]ₘᵣ are directly analogous to the terms used in optical rotation. The units of [θ] are as for [m]. Note that [θ]ₘᵣ = 3300 x Δε.

Fluorescence spectroscopy. In reporting fluorescence excitation and emission spectra it should be stated whether intensities, F, are relative, normalized or corrected (and the nature of the correction).

Fluorescence-polarization data and spectra are reported as polarization ratio, P, or preferably anisotropy ratio, A; both are dimensionless.

Nuclear magnetic resonance. N.m.r. chemical-shift data, δ, are expressed as parts per million (p.p.m.) and the reference compound must be quoted. The recommended convention is that downfield shifts are positively signed. Coupling constants are expressed in Hz.

For reporting structural n.m.r. data the style suggested is: δ (p.p.m.) (solvent) chemical-shift value [integration, peak type, coupling constant (in Hz), designation (relevant proton in Italics)]. E.g. δ (p.p.m.) [(¹H]chloroform) 0.92 (δH, d, J 6 Hz, CH(CH₃)₂), 2.16 (2H, t, J 7 Hz, CH₂CO₂). Single, doublet etc. are abbreviated to s, d etc. without definition, but other descriptions, e.g. broad and overlapping, should be in full.

Electron spin resonance, electron paramagnetic resonance. Derivative spectra are given, unless otherwise stated; a scale of the magnetic-field strength (in mT) and/or g values should be given. Peaks are described as, e.g., 'the g = 2 peak'.

Mössbauer spectroscopy. The absorption (in %, arbitrary units or crude channel counts) is plotted against the doppler velocity, v (in mm/s). The chemical shift, δ, in
units of mm/s should be quoted relative to a specified standard (e.g. metallic iron at 290 K). The temperature should always be given and the applied magnetic field, if any, should be precisely described.

Statistical treatment of results
Wherever possible, all authors should adopt a statistical approach in reporting their results. Data from a sufficient number of independent experiments should be reported to permit evaluation of the reproducibility and significance of the results. When the object is to determine the value of a quantity or the statistical characteristics of a population, sufficient information is usually conveyed by the following: (i) the number of independent experiments (replicate measurements in an individual animal or preparation and results from pooled tissues etc. represent only one independent estimate); (ii) the mean value; (iii) the standard deviation (s.d.), the coefficient of variation or the standard error of the estimate of mean value (s.e.m.), as may be appropriate. It should be made clear whether the standard deviation or the standard error is used. A convenient form for inclusion in a table is, for example $263 \pm 2.5 \ (10)$, where the number in parentheses represents the number of values used in calculating the mean.

When any significance is claimed, the test of significance used should be stated and an estimate of the probability given.

Statistical tests appropriate for a normal distribution will be assumed unless stated otherwise.

Symbols for physical units
The Biochemical Journal uses the recommended SI symbols for units [see Pure Appl. Chem. (1970) 21, 1–44; IUPAC Manual, see page 9]. Preference should be given to the recommended SI units, e.g. either ‘42 kJ/mol’ or ‘42 kJ/mol (10 kcal/mol)’, is permissible, but not ‘10 kcal/mol’ alone. Details are given below under ‘Abbreviations, symbols, conventions and definitions’ (pp. 15–20). The symbol for the plural of a unit is the same as that for the singular.

Tables
Each table should be supplied with an informative heading, which should be underlined, and an explanatory legend, starting on a new line and typed double-spaced. The heading and legend should make the general meaning comprehensible without reference to the text. Footnotes should be as few as possible. Conditions specific to the particular experiment should be stated. Reference to the text for general experimental methods is permissible provided that there is no ambiguity. The units in which the results are expressed, e.g. g/100 ml, should be given at the top of each column, and not repeated on each line of the table.

Tables should be typed on separate sheets and their approximate position in the text indicated. Words or numerals should be repeated on successive lines: ‘ditto’ or ‘/’ is not to be used.

Trade names
The names of the manufacturers or suppliers of special apparatus or materials should be given. Wherever possible, the chemical nature of proprietary material should be specified at the first mention.

Unique biological materials
It is expected that authors will make samples of unique biological materials (including cell lines, DNA clones and antibodies) available to academic workers who request them. Authors are urged to deposit cell lines of more than local interest with appropriate collections at national centres (e.g. in the U.K. at the National Collection of Animal Cell Culture, Centre for Applied Microbiology and Research, Porton Down, Salisbury, Wilts. SP4 0J6, and in the U.S.A. at the American Type Culture Collection, 12301 Parklawn Drive, Rockville, MD 20852).

Nomenclature

BIOCHEMICAL NOMENCLATURE
As far as possible authors should follow the Recommendations of the Nomenclature Committee of IUB and the IUPAC–IUB Joint Commission on Biochemical Nomenclature.

General
1. Abbreviations and symbols for chemical names of special interest in biological chemistry: Biochem. J. (1966) 101, 1–7 (extended by many of the items below).
5. Nomenclature of α-amino acids: Biochem. J. (1975) 149, 1–16 (replaced by item 4, but Appendices A and B contain an extensive list of naturally occurring amino acids).
Enzymes

Nucleic acids

Lipids

Carbohydrates

Miscellaneous

Comments on the Recommendations should be sent to the Nomenclature Committee of IUB (Secretary: A. Cornish-Bowden, CNRS – CBM, 31 chemin Joseph-Aiguier, F-13274 Marseille Cedex 9, France).

Abbreviations
The Biochemical Journal in general follows the Recommendation of the IUPAC–IUB Joint Commission on Biochemical Nomenclature (see the preceding section) and discourages the use of other abbreviations or symbols (except for well-known chemical names, e.g. Me, Et, Ph, Ac). Abbreviations may be used in the title where necessary to avoid unwieldiness. All abbreviations except those listed below must be defined together in a footnote on the title page. New abbreviations should be coined only for unwieldy names, and then only if their repeated use is essential; symbols for part of chemical names are preferred (e.g. Me, for DM, H4 for TH). The name of an entity can often be replaced by short alternatives such as ‘the compound’, ‘the protein’, ‘the enzyme’ etc., or even by ‘it’. If an abbreviation or symbol is used for a biochemical entity, some indication of the type or class of material should be given at first mention in the text. This 'turnip yellow-mosaic virus' may be abbreviated to 'TYMV' but not to 'TYMV' and 'poly(XY)' should not be 'PXY'. Cumbernames of enzymes used frequently may be abbreviated, although this practice is not encouraged. Any such abbreviation should be based on the EC recommended name, which should be given, together with the EC number, in the footnote.

Abbreviations that may be used without definition and are therefore 'accepted' are:

- ADP, CDP, GDP, IDP, UDP, XDP, dTDP
- AMP etc.
- ATP etc.
- ATPase etc.
- CM-cellulose
- CoA and acyl-CoA
cyclic AMP etc.
dansyl
DEAE-cellulose
DNA, cDNA
DNAase
5'-Pyrophosphates of adenosine, cytidine, guanosine, inosine, uridine, xanthosine, thymidine
Adenosine 5'-phosphate etc.
Adenosine 5'-triphosphate etc.
Adenosine triphosphatase etc.
Carboxymethylcellulose
Coenzyme A and its acyl derivatives
Adenosine 3',5'-phosphate etc.
5-Dimethylaminonaphthalene-1-sulphonyl
Diethylaminoethylcellulose
Deoxyribonucleic acid, complementary DNA
Deoxyribonuclease
EDTA  Ethylenediaminetetra-acetate
EGTA  \((\text{HO}_2\text{C}-\text{CH}_2)_2\text{N}[-\text{CH}_2]_2-\text{O}-\
\text{[CH}_2]_5-\text{O}-\text{[CH}_2]_5-\text{N}()\text{(CH}_2-\text{CO}_2\text{H})_2\
\text{[ethyleneglycolbis(aminomethylene)tetra-acetate]}
FAD   Flavin--adene dinucleotide
FMN   Flavin mononucleotide
GSH, GSSG  Reduced and oxidized glutathione respectively
IgG etc.  Immunoglogulin G etc.
NAD*  Nicotinamide--adenine dinucleotide
NADP*  Nicotinamide--adenine dinucleotide phosphate
NMN   Nicotinamide
Pi, PPi  Orthophosphate, pyrophosphate
RNA, mRNA, nRNA, rRNA, tRNA†  Ribonucleic acid and messenger, nuclear, ribosomal and transfer
RNAase  Ribonuclease
SDS   Sodium dodecyl sulphate


The three-letter symbols may be used in representing polymers or sequences, and in tables and figures; the one-letter symbols are less easily understood and should be used only for comparisons of long sequences. Neither set of symbols need be defined.

<table>
<thead>
<tr>
<th>Alanine</th>
<th>Arginine</th>
<th>Asparagine</th>
<th>Aspartic acid</th>
<th>Aspartic acid or asparagine (undefined)</th>
<th>Cysteine</th>
<th>Cystine (half)</th>
<th>Glutamine</th>
<th>Glutamic acid</th>
<th>Glutamic acid or glutamine (undefined)</th>
<th>Glycine</th>
<th>Histidine</th>
<th>Hydroxylysine</th>
<th>Hydroxyproline</th>
<th>Isoleucine</th>
<th>Leucine</th>
<th>Lysine</th>
<th>Methionine</th>
<th>Ornithine</th>
<th>Phenylalanine</th>
<th>Proline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ala</td>
<td>Arg</td>
<td>Asn</td>
<td>Asp</td>
<td>Asx</td>
<td>Cys</td>
<td>Cys or Cys</td>
<td>Glu</td>
<td>Glu</td>
<td>Glx</td>
<td>Gly</td>
<td>His</td>
<td>Hyl</td>
<td>Hyl</td>
<td>Ile</td>
<td>Leu</td>
<td>Lys</td>
<td>Met</td>
<td>Orn</td>
<td>Phe</td>
<td>Pro</td>
</tr>
<tr>
<td>A</td>
<td>R</td>
<td>N</td>
<td>D</td>
<td>B</td>
<td>C</td>
<td></td>
<td>Q</td>
<td>E</td>
<td>Z</td>
<td>G</td>
<td>H</td>
<td>—</td>
<td>—</td>
<td>I</td>
<td>L</td>
<td>K</td>
<td>M</td>
<td>—</td>
<td>F</td>
<td>P</td>
</tr>
</tbody>
</table>

Xaa specifies a 'decampeptide composed of four amino acids whose sequence has been established, four for which the sequence is unknown and then three in known sequence. The glycine on the left carries the free amino group and the alanine on the right the free carboxyl group. The prefix poly or the suffix subscript \( n \) may accompany these symbols to indicate polymers [see Biochem. J. (1972) 127, 753-756].

Special considerations apply to the spacing and punctuation of the one-letter symbols [see Biochem. J. (1984) 219, 366-368].

In polymers or sequences the three-letter symbols should be joined by hyphens if the sequence is known, or by commas if it is not; e.g.:

Gly-Ile-Gly-Phe(Gly,Tyr,Val,Ser)Leu-Val-Ala

represents an undecapeptide composed of four amino acids whose sequence has been established, four for which the sequence is unknown and then three in known sequence. The glycine on the left carries the free amino group and the alanine on the right the free carboxyl group. The prefix poly or the suffix subscript \( n \) may accompany these symbols to indicate polymers [see Biochem. J. (1972) 127, 753-756].

Symbols for nucleosides, nucleotides and polynucleotides [see Biochem. J. (1970) 120, 449-454, which also contains symbols for bases (three-letter system), and Biochem. J. (1985) 229, 281-286]

The symbols for ribonucleosides, which need not be defined, are as follows (the prefix \( r \) should be used if there is possible ambiguity):

<table>
<thead>
<tr>
<th>A</th>
<th>Adenosine</th>
<th>C</th>
<th>Cytidine</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Guanosine</td>
<td>T</td>
<td>Ribosylthymine</td>
</tr>
<tr>
<td>I</td>
<td>Inosine</td>
<td>U</td>
<td>Uridine</td>
</tr>
<tr>
<td>X</td>
<td>Xanthosine</td>
<td>Ψ</td>
<td>5-Ribosyluracil (pseudouridine)</td>
</tr>
</tbody>
</table>

The 2'-deoxyribonucleosides are designated by the same symbols preceded by \( d \), e.g.:

<table>
<thead>
<tr>
<th>dA</th>
<th>2'-Deoxyribosladenine</th>
</tr>
</thead>
<tbody>
<tr>
<td>dT</td>
<td>2'-Deoxyribosylthymine (thymidine)</td>
</tr>
</tbody>
</table>

The letter \( p \) (for terminal phosphate only) or a hyphen (for phosphodiester group only) to the left of a nucleoside symbol indicates a 5'-phosphate; to the right it indicates a 3'-phosphate, e.g.:

<table>
<thead>
<tr>
<th>pA-G</th>
<th>5'-Phosphoadenyl(3'-5')-guanosine or guanylyl(5'-3')-adenosine 5'-phosphate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Gp</td>
<td>Adenyl(3'-5')guanosine 3'-phosphate</td>
</tr>
<tr>
<td>d(A-T)</td>
<td>Deoxyadenyl(3'-5')thymidine</td>
</tr>
<tr>
<td>A-G-cyclic-p</td>
<td>Adenyl(3'-5')guanosine or A-G &gt; p 2',3'-phosphate</td>
</tr>
</tbody>
</table>

Other points of attachment may be indicated by numerals, e.g.:

| A2'-5'G2'p | Adenyl(2'-5')guanosine 2'-phosphate |
| A-G(mixed) | A mixture of A-Gp and 2'-3'-p A-G2'p |

In sequences, oligonucleotides or polynucleotides the phosphate between nucleoside symbols is shown by a hyphen if the sequence is known, or by a comma if it is not; e.g.:

\[ \text{G-A-U(C}_2\text{,U)Gp} \]
indicates a heptanucleotide composed of three nucleotides of known sequence but with a trinucleotide of unknown sequence before the final Gp. The hyphens may be omitted.

For sequences that are repetitive or obscure, shorter forms may be used [see Biochem. J. (1972) 127, 753–756], e.g.:

- poly(A) a simple homopolymer of A
- poly(A₉C₂) random co-polymer of A and C in 3:2 proportions
- poly[d(A-T)] or poly(dA-dT) alternating co-polymer of dA and dT

The prefix co-poly or oligo may replace poly, if desired. An alternative form is, e.g., Aₙ for poly(A), where the subscript n may be replaced by numerals indicating actual size. Similarly, d(A-T)ₙ etc. may be used for poly(dA-dT) etc. It should be noted that poly prefixes follow the prefix 'poly'.

Associated (e.g. hydrogen-bonded) chains, or bases within chains, are indicated by a centre dot (not a hyphen or a plus sign) separating the complete names or symbols; non-associated chains are separated by a plus sign, and unspecified or non-associated association by a comma; e.g.:

- poly(A)-poly(U)* associated poly(A) and poly(U)
- poly(G)-2poly(C) triple-stranded complex of poly(G) and poly(C) in the proportions 1:2
- poly(dA-dC)-poly(dG-dT) associated poly(dA-dC) and poly(dG-dT)
- poly(A)+poly(U)* non-associated poly(A) and poly(U)
- poly(A),poly(U) poly(A) and poly(U), no definite information on association

The abbreviations kb (kilobases) and bp (base pair) may be used in discussions of nucleic acid sequences.

The use of a single symbol to designate a variety of possible nucleotides at a single position has become widespread over the past few years. The following set of symbols, applicable to both DNA and RNA, has been recommended. These symbols do not discriminate between DNA and RNA, and the symbol T is used at all positions where U might appear in the RNA. Sequences may be assumed to have a deoxyribose phosphate (DNA) backbone unless otherwise specified; in circumstances where confusion between DNA and RNA is possible the sequence may be prefixed with the lower-case letter d or r.

<table>
<thead>
<tr>
<th>Base</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>guanine</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>adenine</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>thymine</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>cytosine</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>G or A</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>T or C</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>A or C</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>G or T</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>G or C</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>W or A</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>A or C</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>G or T</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>G or C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>G or A</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>G or A</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>dGlcp (1→4)-dGlcp (1→4)-dManp</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>dXylp</td>
<td></td>
</tr>
</tbody>
</table>


These are for use only in representing polymers or sequences and in tables and figures, and need not be defined:

- Ara Arabinose
- Glc§ Glucose
- dRib† 2-Deoxyribose
- Fru Fructose
- Rib Ribose
- Fuc Fucose
- Xyl Xylose
- Gal Galactose

When it is necessary to indicate furanose or pyranose, the letter θ or ρ after the saccharide symbol may be used: e.g. Ribθ for ribofuranose.

The following suffixes may be used, also without definition, to indicate derivatives:

- A for uronic acid (e.g. GlcA for glucuronic acid, GalA for galacturonic acid)
- N and NAc for 2-amino-2-deoxysaccharides and their N-acetyl derivatives (e.g. GlcN for glucosamine and GalNAc for N-acetylgalactosamine)

Note: NeuAc or AcNeu suffixes for N-acetylneuraminate [see Biochem. J. (1978) 171, 34].

Two systems (the extended or the condensed) exist for the representation of oligosaccharide chains. Either may be used.

In the extended system the configurational symbol (d or l) is included before the symbol for the monosaccharide, and is separated therefrom by a hyphen. The anomeric symbol (α or β) is included before the configurational symbol and separated therefrom by a hyphen. Between the symbol (abbreviated name) of one monosaccharide group or residue and the next are placed two locants that indicate the respective positions involved in this glycosidic union. These locants are separated by an arrow (directed from the locant corresponding to the glycosyl carbon atom to the locant corresponding to the carbon atom carrying the hydroxyl group involved) and are enclosed in parentheses. The position of a branch is indicated above or below the main chain, with the numerals and an arrow indicating the glycosidic linkage:

\[ α-d-\text{Glc}p-(1→4)-β-d-\text{Glcp}-(1→4)-\text{d-Manp} \]

\[ \uparrow \]

\[ 2 \]

\[ 1 \]

β-d-Xylp

The hyphens, except that separating the configurational symbol and the symbol for the monosaccharide, may be omitted.

In the condensed system the common configuration and ring size are implied in the symbol. Thus, Glc means D-glucopyranose; Fru, D-fructofuranose; and Fuc, L-fucopyranose. Whenever the configuration or ring size is found to differ from the common one, or is to be emphasized, this may be indicated by using the appropriate symbols from the extended system. The

* Also 'adenine-thymine base pair' or 'A-T base pair' in the text.
† Also 'A+T content' (and 'A-T sequence'), not 'AT content' (nor 'AT sequence'), in the text.
§ Where no ambiguity can arise, the single-letter symbol G may be used, but is not preferred.
anomeric descriptor indicates the configuration of the glycoside linkage, and is therefore placed before the locant if the direction of the bond is to the right, or after the locant if the direction of the bond is to the left. The two locants are separated by a hyphen. No hyphens are used between the symbol for the sugar and the parentheses indicating the glycosidic bond; such parentheses may be omitted in representing branched oligosaccharides, when parentheses are used to indicate the branches:

\[
\text{Glcz1-4(Xylβ1-2)Glcz1-4Man}
\]

The condensed form may be shortened further by (i) omitting locants of anomeric carbon atoms, (ii) omitting the parentheses around the specifications of linkage, and (iii) omitting hyphens if desired:

\[
\text{Glcz4(Xylβ2)Glcz4Man}
\]

CHEMICAL NOMENCLATURE

The IUPAC Rules on chemical nomenclature should be followed, the most important of these being as follows.

1. Nomenclature of inorganic chemistry and How to name an inorganic substance (combined set) [(1977) Pergamon Press, Oxford].


Elementary analyses and physical properties

The new compound (name in italics) had m.p. 175 °C (decomp.) [α]D [15] +17±2° (c 1.6 in water), light-absorption max. in ethanol 226 and 265 nm (ε 2200 and 2500 respectively) (Found: C, 40.8; H, 6.9; N, 11.5; OMe, 26.0; C₉H₁₈N₂O₄ requires C, 40.7; H, 6.8; N, 11.9; OMe, 26.3%).

The known compound (name in roman type) had m.p. 178–179 °C, unchanged by admixture with an authentic sample kindly supplied by Dr. Z. (Found: C, 48.6; H, 6.1; OMe, 50.1. Calc. for C₁₀H₁₂O₅: C, 48.4; H, 6.4; OMe, 50.0%). Or: The known compound had m.p. 178–179 °C.

The mixed m.p. with an authentic sample (m.p. 179–181 °C) prepared by the method of X & Y (1932) was 178–180 °C (Found: C, 49.4; H, 3.8; N, 3.9; loss at 100 °C, 5.1. Calc. for C₂₅H₂₁N₂H₂O₂: C, 49.7; H, 3.9; N, 4.2; H₂O, 5.3%). (If water of crystallization is claimed, evidence should be given, e.g. as loss at 100 °C as above, or the reason why it cannot be given should be explained.)

Distillation of the product gave a middle fraction (0.3 g), b.p. 120 °C/1.9 kPa (15 mmHg), nD⁺ 1.4767.

Elementary analyses. Percentages should generally be given to one place of decimals only. Elements are to be listed in the order C, H and then the remainder in alphabetical order of symbols.

Melting points. It is desirable to state whether these are corrected or uncorrected for the emergent stem of the thermometer.

Specific optical rotations. An estimate of the error should be given.

Formulae

Chemical symbols may be used for elements, groups and simple compounds, but authors are advised that the excessive use of chemical symbols may reduce the readability of a paper.

Where formulae of more complex organic molecules are included they should, if possible, be written in one line, as this saves space and expense in printing. Dashes are used to represent the links in the main chain; side chains are in parentheses, and condensed main chains are in square brackets, e.g.:

\[
\text{CH}_3\text{-CH-CH(OH)-CH}_3
\]

\[
\text{H}_2\text{N-[CH}_3\text{]_3-CH(NH}_2\text{)-CO}_\text{H}
\]

Formulæ with rings or branched chains should be clearly written on a separate sheet so that they can be copied by the draughtsman. Hetero atoms should be shown in the ring, and aromatic rings must show double bonds.

R, R', R* (or R', R*, R') if more than three should be used to denote variable substituents in formulæ.

C₉₆ acid is used to denote an acid containing 20 carbon atoms and C-3 or C(3) to denote the carbon atom numbered 3. C₁₈₀; C₁₈₁; etc. are used similarly to denote the number of double bonds in an unsaturated fatty acid.

Ions

These should be represented thus: Na⁺, Zn²⁺, Cl⁻, PO₄³⁻.

Isotopically labelled compounds

The symbol for the isotope introduced is placed in square brackets directly attached to the front of the name (word), as in [¹⁴C]urea. When more than one position in a substance is labelled by means of the same isotope and the positions are not indicated (as below), the number of labelled positions is added as a right-hand subscript, as in [¹⁴C₂]glycollic acid. The symbol '¹⁴C' indicates uniform and '¹⁳C' general labelling, e.g. [U-¹⁴C]glucose (where the ¹⁴C is uniformly distributed among all six positions) and [G-¹⁴C]glucose (where the ¹⁴C is distributed among all six positions, but not necessarily uniformly); in the latter case it is often sufficient to write simply [¹⁴C]glucose'.

The isotopic prefix precedes that part of the name to which it refers, as in sodium [¹⁴C]formate, iodo[¹⁴C]acetic acid, 1-aminol[¹⁴C]methylene-cyclopentanol (H₃N-CH₂-CH₂-OH), x-naphthyl[¹⁴C]oic acid (C₁₀H₇-¹⁴CO₂H), 2-acetamido-7-[¹³¹I]iodofluorene, fructose 1,6-[¹⁴C]bisphosphate, d-[¹⁴C]glucose, 2H-[²-²H]pyran, S-[⁸-¹⁴C]adenosyll-[¹⁴S]methylthione. Terms such as '¹³¹I-labelled albumin' should not be contracted to '¹³¹I-albumin' (since native albumin does not contain iodine (but '¹³¹I-albumin can be used)), and '¹⁴C-labelled amino acids' should similarly not be written as
"[14C]amino acids" (since there is no carbon in the amino group).

When isotopes of more than one element are introduced, their symbols are arranged in alphabetical order, including 2H and 3H for deuterium and tritium respectively.

When not sufficiently distinguished by the foregoing means, the positions of isotopic labelling are indicated by Arabic numerals, Greek letters, or prefixes (as appropriate), placed within the square brackets and before the symbol of the element concerned, to which they are attached by a hyphen; examples are [1-2H]ethanol (CH₃-C₂H₂OH), [1-14C]aniline, L-[2-14C]leucine (or L-[2-15N]leucine), [carboxy-14C]leucine, [Me-14C]iso-leucine, [2,3,4-14C]maleic anhydride, [6,7-14C]xanthopterin, [3,4,14C,13S]methionine, [2-13C,1-14C]acetaldehyde, [3-14C,2,3-2H,15N]serine.

The same rules apply when the labelled compound is designated by a standard abbreviation or symbol, other than the atomic symbol, e.g. [γ-32P]ATP.

For simple molecules, however, it is often sufficient to indicate the labelling by writing the chemical formulae, e.g. 14CO₂, H₂18O, D₂O, H₂35SO₄, with the prefix superscripts attached to the proper atomic symbols in the formulae. The square brackets are not to be used in these circumstances, nor when the isotopic symbol is attached to a word that is not a chemical name, abbreviation or symbol (e.g. "12I-labelled").

### Isotopically substituted compounds

The attention of authors is drawn to the distinction between 'isotopically labelled' and 'isotopically substituted' compounds [see Eur. J. Biochem. (1978) 86, 9–25].

### Abbreviations, symbols, conventions and definitions

This list includes accepted symbols and abbreviations and also serves as an index; definitions are included that may be of help to authors. See also the lists of relevant documents (pp. 10–15).

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Symbols</th>
<th>Conventions and Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>absorbance</td>
<td>A</td>
<td>( \Delta ) (use SI units: ( 1 \Delta = 0.1 ) nm)</td>
</tr>
<tr>
<td>absorption coefficient, molar</td>
<td>( \varepsilon )</td>
<td>(see p. 9)</td>
</tr>
<tr>
<td>acceleration due to gravity ( (9.81 \text{ m}\cdot\text{s}^{-2}) )</td>
<td>( g )</td>
<td>(see p. 4)</td>
</tr>
<tr>
<td>adenosine 3',5'-phosphate</td>
<td>cyclic AMP</td>
<td></td>
</tr>
<tr>
<td>adenosine 5'-phosphate</td>
<td>AMP</td>
<td></td>
</tr>
<tr>
<td>adenosine 5'-pyrophosphate</td>
<td>ADP</td>
<td></td>
</tr>
<tr>
<td>adenosine triphosphatase</td>
<td>ATPase</td>
<td></td>
</tr>
<tr>
<td>adenosine 5'-triphosphate</td>
<td>ATP; the three phosphorus atoms are distinguished as ( \alpha, \beta, \text{ and } \gamma ), thus: adenosine-P( ^+)-O-P( ^\beta)-O-P( ^\gamma)</td>
<td></td>
</tr>
<tr>
<td>alternating current</td>
<td>a.c.</td>
<td></td>
</tr>
<tr>
<td>amino acids, symbols for</td>
<td>p. 12</td>
<td></td>
</tr>
<tr>
<td>ampere</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>angstrom</td>
<td>Å</td>
<td></td>
</tr>
<tr>
<td>approximately</td>
<td>approx. (before numerical values only, or use about, not c. or ca.)</td>
<td></td>
</tr>
<tr>
<td>aqueous</td>
<td>aq.</td>
<td></td>
</tr>
<tr>
<td>ascorbic acid</td>
<td>alternative permitted vitamin C</td>
<td></td>
</tr>
<tr>
<td>atmosphere</td>
<td>atm (use SI units: ( 1 ) atm = 101325 Pa)</td>
<td></td>
</tr>
<tr>
<td>atomic weight</td>
<td>at.wt.</td>
<td></td>
</tr>
<tr>
<td>atto ( (10^{-18} \times) )</td>
<td>a (prefix)</td>
<td></td>
</tr>
<tr>
<td>bar (pressure)</td>
<td>bar (use SI units: ( 1 ) bar = 10⁵ Pa)</td>
<td></td>
</tr>
<tr>
<td>barn ( (10^{-28} \text{ m}^2) )</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>base pair</td>
<td>bp</td>
<td></td>
</tr>
<tr>
<td>becquerel ( (\text{s}^{-1}) )</td>
<td>Bq</td>
<td></td>
</tr>
<tr>
<td>boiling point</td>
<td>b.p.</td>
<td></td>
</tr>
<tr>
<td>buffers</td>
<td>pp. 8–9</td>
<td></td>
</tr>
</tbody>
</table>

Vol. 249
calciferol. use ergocalciferol or erocalciferol, alternative permitted vitamin D₃

calculated calc.
*calorie, I.T. cal₁₉₃₇ (use SI units:
1 cal₁₉₃₇ = 4.1868 J)
*calorie, thermochemical cal₁₈₄ (use SI units:
1 cal₁₈₄ = 4.184 J)
candela cd
capric acid use decanoic acid
caproic acid use hexanoic acid
caproyl use hexanoyl
capryl, caproinyl use decanoyl
caprylic acid use octanoic acid
capryl, capryloyl use octanoyl
carboxylic acid use benzyloxy carbonyl
carbenzoxycarboxymethylcellulose CM-cellulose
catalytic-centre activity number of molecules of substrate transformed/s per catalytic centre
centi (10⁻² x) cm
centimetre cm
centimetre gram c.g.s.
centrifuging p. 4
cholecalciferol alternative permitted calciol or vitamin D₃
chromatography pp. 4–5
circular dichroism (see also ellipticity) c.d. (Δε) (see p. 9)
cocarboxylase use thiamin pyrophosphate
coefficient of variation standard deviation/mean value (see p. 10)
coenzyme A and its acyl derivatives CoA and acyl-CoA
compare cf.
concentrated conc.
concentration concn.
concentration (symbol, e.g. in specific rotation) c
constant, equilibrium k (see p. 5)
constant, velocity k
corrected (e.g. m.p. for emergent stem) corr.
coulomb (s·A) C
counts/min, counts/s. c.p.m., c.p.s.
crystalline, crystallized cryst.
cubic cu. or as e.g. mm³
curie (3.7 x 10¹⁰ s⁻¹) Ci
cycles per second Hz
cytidine 5'-phosphate. CMP
cytidine 5'-pyrophosphate. CDP
cytidine 5'-triphosphate. CTP
dalton (A of the mass of one atom of nuclide ¹³C, i.e. 1.663 x 10⁻²⁴ g).

data (N.B.: plural) use only in the sense of 'information given'
data, deposition of p. 5
deci (10⁻¹ x) d (prefix) (see p. 8)
decomposition (m.p.) decomp.
degrees Celsius (°C = T/K – 273.15).
degrees Kelvin K (not °K)
deka (10 x) da (prefix) (see p. 8)
density (g/ml) d
density, relative. not deoxy; symbol d
deoxy (prefix) deoxyribonuclease
deoxyribonucleic acid DNA
DNA p. 12
not permitted; use diffusible (see p. 5)
tnot used; for diffusible material use diffusate (see p. 5)
diethylaminoethylcellulose DEAE-cellulose

diffusion coefficient D, D₀, D₁₀₀, etc. (as for sedimentation coefficient) (see p. 4)
dilute dil.
5-dimethylamino-naphthalene-1-sulphonyl dansyl
direct current d.c.
disintegrations/min, disintegrations/s d.p.m., d.p.s.
dissociation constant, minus log of. pK, plural pK values
disulphide group alternative permitted S–S

dithionite (sodium) Na₂S₂O₄, not hydrosulphite, hyposulphite

dry ice use solid CO₂

dyne dyn (use SI units:
1 dyn = 10⁻⁵ N)
electrode potential, standard E₀

* The symbol 'cal' may be used where the degree of accuracy does not justify distinction between cal₁₉₃₇ and cal₁₈₄.
ethanol, ethanolic

experiment

electrophoretic

mobility

m (see p. 5)

elementary analyses

p. 14

electrophoresis (see also circular
dichroism)

[\delta] = 3300 \Delta \varepsilon (see p. 9)

enthalpy (change)

\Delta H (kJ \cdot mol^{-1})

entropy (change)

\Delta S (kJ \cdot mol^{-1} \cdot K^{-1})

not

ethanol, ethanolic

not ethyl alcohol, not

alcoholic

ethylenediaminetetra-

acetate

EDTA

‘ethyleneglycolbis-

(aminooethyl ether)tetra-

acetate’

(HO\_2C-CH\_2)\_2N-\{CH\_2\}_\_\_O-\{CH\_2\}_\_\_N(CH\_2-CO\_2H)\_\_\_O-

\{CH\_2\}_\_\_N(CH\_2-CO\_2H)\_\_\_O-

EGTA

experiment (with reference
cumbral)

Expt.; plural Expts.

extinction.

log(I_\_0/I) (see p. 9); use

absorbance

farad

(m^2 \cdot kg^{-1} \cdot s^4 \cdot A^2

= A \cdot s \cdot V^{-1} = C \cdot V^{-1})

F

Faraday (quantity of
electricity associated

with 1 g-equiv. of

chemical change)

F

fast protein liquid chrom-

atography

f.p.l.c.

fatty acids

p. 14

femto (10^{-15} x)

f (prefix)

figure (with reference
cumbral)

Fig.; plural Figs.

figures, preparation of

pp. 6-7

flavin-adene

dinucleotide

FAD

flavin mononucleotide

FMN

fluorescence anisotropy

A (see p. 9)

fluorescence polarization

P (see p. 9)

foot

ft (use SI units:

1 ft = 0.3048 m)

foot-candle

ft-candle (use SI units:

1 ft-candle = 10.7639 lx)

de

formulae

p. 14

free energy (Gibbs)

(change)

\Delta G (kJ \cdot mol^{-1})

frictional coefficient

(molar)

f

frictional coefficient

(molar) for sphere of

same volume

f_0

gas constant per mole

R

gas-liquid

cromatography

g.l.c.

gauss

G (use SI units:

1 G = 10^{-4} T)

giga (10^9 x)

G (prefix)

glutathione, oxidized

GSSG

glutathione, reduced

GSH

\alpha-glycerophosphate

use sn-glycerol 3-phosphate

when the configuration is

to be specified

gram

mol preferred, otherwise

g-atom

gram-molecule

mol

gravitational field, unit of

(in centrifuging)

(9.81 m \cdot s^{-2})

\( \mathbf{g} \) (see p. 4)

gray

(m^2 \cdot s^{-2} \cdot A \cdot kg^{-1})

Gy

guanosine

3',5'-phosphate

cyclic GMP

guanosine 5'-phosphate

GMP

guanosine

5'-pyrophosphate

GDP

guanosine

5'-triphosphate

GTP

haem, protohaem

prosthetic group of

haemoglobin

hecto (10^2 x)

h (prefix) (see p. 8)

henry

(m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}

= V \cdot A^{-1} \cdot s)

H

hertz

Hz

high pressure (or high

performance) liquid

chromatography

h.p.l.c.

Hill coefficient

h (not n)

hour

(3600 s)

h

hydrogen ion concentration,

minus log of

pH, plural pH values

hydrosulphite,

sulphite

not used, see dithionite

illustrations

pp. 6-7

immunoglobulin G etc.

IgG etc.
<table>
<thead>
<tr>
<th>Chemical Term</th>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>In</td>
<td>in (use SI units: 1 in = 2.54 x 10^-2 m)</td>
</tr>
<tr>
<td>Infrared</td>
<td></td>
<td>i.r.</td>
</tr>
<tr>
<td>Inhibitor constant</td>
<td>(K_i) (dissociation constant of inhibitor–enzyme complex)</td>
<td></td>
</tr>
<tr>
<td>Inosine 5’-phosphate</td>
<td>IMP</td>
<td></td>
</tr>
<tr>
<td>Inosine 5’-pyrophosphate</td>
<td>IDP</td>
<td></td>
</tr>
<tr>
<td>Inosine 5’-triphosphate</td>
<td>ITP</td>
<td></td>
</tr>
<tr>
<td>Insoluble</td>
<td></td>
<td>insol.</td>
</tr>
<tr>
<td>International unit</td>
<td>i.u.</td>
<td></td>
</tr>
<tr>
<td>Ionic strength (mol/l)</td>
<td>(I)</td>
<td>p. 14</td>
</tr>
<tr>
<td>Isoelectric point (the pH at which a molecule has no effective charge)</td>
<td>(pI)</td>
<td></td>
</tr>
<tr>
<td>Isoenzyme</td>
<td></td>
<td>not isozyme</td>
</tr>
<tr>
<td>Isotonic</td>
<td></td>
<td>use iso-osmotic and specify composition of solution, e.g. 0.9% NaCl solution</td>
</tr>
<tr>
<td>Isotopically labelled compounds</td>
<td></td>
<td>p. 14</td>
</tr>
<tr>
<td>Joule</td>
<td>J</td>
<td>(m^2·kg·s^-2 = N·m)</td>
</tr>
<tr>
<td>Katal (amount of enzyme that can catalyse the transformation of 1 mol of substrate/s under conditions specified)</td>
<td>kat</td>
<td>(see p. 5)</td>
</tr>
<tr>
<td>Kelvin</td>
<td>K</td>
<td>(not °K)</td>
</tr>
<tr>
<td>Kephalin</td>
<td></td>
<td>use amino phospholipids</td>
</tr>
<tr>
<td>Keto acid</td>
<td></td>
<td>keto used only generically, otherwise oxo</td>
</tr>
<tr>
<td>Keto sugars</td>
<td></td>
<td>use pentulose, hexulose etc., not ketopentose, keto-hexose etc.</td>
</tr>
<tr>
<td>Kilo (10^3 x)</td>
<td>k</td>
<td>(prefix)</td>
</tr>
<tr>
<td>Kilobases</td>
<td>kb</td>
<td></td>
</tr>
<tr>
<td>Kilogram</td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td>Krebs–Ringer solution level</td>
<td></td>
<td>reference to be given</td>
</tr>
<tr>
<td>Light petroleum</td>
<td></td>
<td>not petroleum ether: boiling range to be stated</td>
</tr>
<tr>
<td>Litre (10^-3 m^3 = dm^3)</td>
<td>l</td>
<td>l; where there is the possibility of confusion between the numeral ‘1’ and the letter ‘l’, ‘litre’ should be written in full</td>
</tr>
<tr>
<td>Logarithm (base 10)</td>
<td>log</td>
<td></td>
</tr>
<tr>
<td>Logarithm (base e)</td>
<td>ln</td>
<td></td>
</tr>
<tr>
<td>Lumen (cd·sr)</td>
<td>lm</td>
<td></td>
</tr>
<tr>
<td>Lux (m^-2·cd·sr)</td>
<td>lx</td>
<td></td>
</tr>
<tr>
<td>Mass spectrometry</td>
<td>m.s.</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>max.</td>
<td></td>
</tr>
<tr>
<td>Maxwell</td>
<td>Mx</td>
<td>(use SI units: 1 Mx = 10^-8 Wb)</td>
</tr>
<tr>
<td>Median effective dose</td>
<td>(ED_{50})</td>
<td></td>
</tr>
<tr>
<td>Median lethal dose</td>
<td>(LD_{50})</td>
<td></td>
</tr>
<tr>
<td>Mega (10^4 x)</td>
<td>M</td>
<td>(prefix)</td>
</tr>
<tr>
<td>Melting point</td>
<td>m.p.</td>
<td></td>
</tr>
<tr>
<td>Metabolic quotients</td>
<td>metabolic quotients</td>
<td>should be given as mol/s or (\mu)mol/min for a defined arbitrary quantity of material, e.g. mg dry wt., mg of protein, g wet wt. etc.</td>
</tr>
<tr>
<td>Methanol, methanolic</td>
<td></td>
<td>not methyl alcohol</td>
</tr>
<tr>
<td>Metre</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>Michaelis constant</td>
<td>(K_m)</td>
<td>(see p. 5)</td>
</tr>
<tr>
<td>Micro (10^-6 x)</td>
<td>(\mu)</td>
<td>(prefix)</td>
</tr>
<tr>
<td>Microgram</td>
<td>(\mu)g</td>
<td></td>
</tr>
<tr>
<td>Microlitre</td>
<td>(\mu)l</td>
<td></td>
</tr>
<tr>
<td>Micromolar (concentration)</td>
<td>(\mu)M</td>
<td>or (\mu)mol/l</td>
</tr>
<tr>
<td>Micromole</td>
<td>(\mu)mol</td>
<td></td>
</tr>
<tr>
<td>Micron (10^-6 m)</td>
<td>(\mu)m</td>
<td></td>
</tr>
<tr>
<td>Millimolar (concentration)</td>
<td>(mm)</td>
<td>or (mm)mol/l</td>
</tr>
<tr>
<td>Millimole</td>
<td>(mm)ol</td>
<td></td>
</tr>
<tr>
<td>Milligram</td>
<td>mg</td>
<td></td>
</tr>
<tr>
<td>Millilitre</td>
<td>ml</td>
<td></td>
</tr>
<tr>
<td>Millimetre of mercury (conventional pressure)</td>
<td>mmHg</td>
<td>(use SI units: 1 mmHg (\approx 133.3) Pa)</td>
</tr>
<tr>
<td>Millimicro (10^-9 x)</td>
<td>n</td>
<td>(prefix); not (\mu)n</td>
</tr>
<tr>
<td>Millimicron (10^-12 x)</td>
<td>(n) M</td>
<td></td>
</tr>
<tr>
<td>Millimicron (10^-8 m)</td>
<td>(nm); not (\mu)m</td>
<td></td>
</tr>
<tr>
<td>Millimolar (concentration)</td>
<td>(M)</td>
<td>or (mol/l)</td>
</tr>
<tr>
<td>Millimole</td>
<td>(M)ol</td>
<td></td>
</tr>
<tr>
<td>Molecular mass</td>
<td>molecular mass</td>
<td>unlike ‘relative molecular mass’ this requires units; see dalton</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>use ‘relative molecular mass’ (symbol (M_r))</td>
<td></td>
</tr>
<tr>
<td>Nano (10^-9 x)</td>
<td>n</td>
<td>(prefix)</td>
</tr>
<tr>
<td>Newton (m·kg·s^-2)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Newton-metre (m·N·s)</td>
<td>Nm</td>
<td></td>
</tr>
<tr>
<td>Newton-second (m·N·s)</td>
<td>Ns</td>
<td></td>
</tr>
<tr>
<td>Newton-watt (m·N·s)</td>
<td>Nw</td>
<td></td>
</tr>
<tr>
<td>Newton-second (m·N·s)</td>
<td>Ns</td>
<td></td>
</tr>
<tr>
<td>Newton-watt (m·N·s)</td>
<td>Nw</td>
<td></td>
</tr>
<tr>
<td>Newton-second (m·N·s)</td>
<td>Ns</td>
<td></td>
</tr>
<tr>
<td>Newton-watt (m·N·s)</td>
<td>Nw</td>
<td></td>
</tr>
</tbody>
</table>

* Separated by a hyphen (and no full stop) from a chemical formula or name following it, e.g. 1 M-NaCl; 1 M-NaOH; 1 M-sulphuric acid.
Instructions to authors

nicotinamide–adenine dinucleotide . . . . NAD
nicotinamide–adenine dinucleotide, oxidized . . . . NAD+ preferred
nicotinamide–adenine dinucleotide, reduced . . . . NADH preferred
nicotinamide–adenine dinucleotide phosphate . . . . NADP
nicotinamide–adenine dinucleotide phosphate, oxidized . . . . NADP+ preferred
nicotinamide–adenine dinucleotide phosphate, reduced . . . . NADPH preferred
nicotinamide mononucleotide . . . . NMN
nuclear magnetic resonance . . . . n.m.r.
nucleoside (unspecified) . . . . N (not X)
nucleosides, nucleotides and polynucleotides, symbols for . . . . pp. 12–13
number (in enumerations) . . . . no.
observed . . . . obs.
ohm (m2·kg·s−3·A−2) = V·A−1) . . . . Ω
optical rotation. . . . . specific optical rotation (with concn. 1 g/ml, light-path 10 cm), e.g. [α]25θ,
 [α]25θ mol wt.
molecular optical rotation (= [α]θ mol wt.), e.g. [α]θ mol wt. If a different value, e.g. [α]θ mol wt./
100, is used, this should be stated
optical rotatory dispersion . . . . o.r.d.
optically active isomers . . . . p. 15
orthophosphate (inorganic) . . . . P1
osmolar . . . . osm or osmol/l (the concentration producing an osmotic pressure equal to that of
a molar solution of a perfect solute)
partial specific volume . . . . ϑ
partition coefficient (dimensionless) . . . . α or KD
parts per million . . . . p.p.m.
pascal (m−1·kg·s−2 = N·m−2 = J·m−3) . . . . Pa
per . . . . /
per cent . . . . %

petroleum ether. . . . . not used (see light petroleum)
phosphatide . . . . use phospholipid
pico (10−12 ×) . . . . p (prefix)
poise . . . . P (use SI units: 1 P = 10−1 Pa·s)
polyacrylamide-gel electrophoresis . . . . PAGE (to be defined)
potential difference . . . . p.d.
pound . . . . lb (use SI units: 1 lb ≈ 0.4536 kg)
pound-force per square inch . . . . lbf/in² (use SI units: 1 lbf/in² ≈ 6.9 kPa)
precipitate . . . . ppt.
preparation . . . . prep.
probability of an event's being due to chance alone. . . . P
proton magnetic resonance . . . . p.m.r.
pyridoxine, pyridoxal . . . . alternative permitted vitamin B-6 [see Biochem. J. (1974)
137, 417–421]
pyrophosphate (inorganic) . . . . PPi
rad (10−2 J·kg−1). . . . . rad or rd (Gy preferred)
radian. . . . . rad
recrystallized . . . . recryst.
references . . . . p. 8
refractive index. . . . . n: at stated temperature and
wavelength represent as, e.g. ηθ
relative band speed (partition chromatography) . . . . R, Rr, Rx (see p. 5); plural R values etc.
relative molecular mass . . . . Mr ; preferred name to 'molecular weight'. Molecular mass (unit:
dalton) or molar mass (unit: g·mol−1) may be used when appropriate
reprints . . . . p. 4
respiratory quotient . . . . R.Q. (to be defined)
revolutions . . . . rev.
rev./min . . . . not r.p.m.; use g where possible (see p. 4)
riboflavin . . . . alternative permitted vitamin B2
ribonuclease . . . . RNAase
ribonucleic acid . . . . RNA
ribonucleoprotein . . . . RNP (to be defined)
ribonucleosides, symbols for . . . . p. 12
röntgen (2.58 \times 10^{-4} \text{ C} \cdot \text{kg}^{-1}) \ldots \text{R}

second (time) \ldots \text{s}

sedimentation coefficient \ldots \text{s}^2

sedimentation coefficient corrected to 20 °C in water \ldots \text{s}_{20,w}

sedimentation coefficient at zero concentration \ldots \text{s}

siemens (m^2 \cdot \text{kg}^{-1} \cdot \text{s}^{-3} \cdot \text{A}^2 = \Omega^{-1} = \text{A} \cdot \text{V}^{-1}) \ldots \text{S}

sievert [(\text{J} \cdot \text{kg}^{-1}) \times \text{quality factor}] \ldots \text{Sv}

sodium dodecyl sulphate SDS

solution \ldots \text{soln.}

solutions, concentration of \ldots \text{p}.

solvent systems \ldots \text{e.g. butan-1-ol/acetic acid/water (4:1:1, by vol.), butan-1-ol/acetic acid (4:1, v/v)}

species (singular and plural) \ldots \text{sp., spp.}

square \ldots \text{sq. or as e.g. cm}^2

standard deviation \ldots \text{S.D.}

standard error of estimate of mean value \ldots \text{S.E.M.}

standard temperature and pressure \ldots \text{s.t.p.}

statistical treatments \ldots \text{p.} 10

steradian \ldots \text{sr}

stokes \ldots \text{St (use SI units: 1 St = 10^{-4} \text{ m}^2 \cdot \text{s}^{-1}})

substrates (variable, in organic compounds) \ldots \text{R, R', R', or R1, R2, R3, R4}

(substrate constant) \ldots \text{K}_d (\text{dissociation constant of substrate-enzyme complex})

sugars, symbols for \ldots \text{pp. 13–14}

sulphhydryl \ldots \text{use thiol or SH}

sum \ldots \text{Σ}

Svedberg unit (10^{-13} \text{ s}) \ldots \text{S (see p. 4)}

tables (preparation of) \ldots \text{p. 10}

temperature \ldots (abbreviation) \text{temp. (symbol)} \text{t (empirical), T (absolute)}

tera (10^{12} \times ) \ldots \text{T (prefix)}

tesla (\text{kg} \cdot \text{s}^{-2} \cdot \text{A}^{-1} = \text{V} \cdot \text{m}^{-2} = \text{Wb} \cdot \text{m}^{-2}) \ldots \text{T}

thiamin \ldots \text{alternative permitted vitamin B_1}

thin-layer chromatography \ldots \text{t.l.c.}

thymidine 5'-phosphate \ldots \text{dTTP}

thymidine 5'-pyrophosphate \ldots \text{dTDP}

thymidine 5'-triphosphate \ldots \text{dTTP}

time (symbol) \ldots \text{t}

tocopherol \ldots \text{alternative permitted vitamin E}

torr \ldots \text{Torr (use SI units: 1 Torr ≈ 133.322 Pa)}

trichloroacetic acid \ldots \text{TCA not used}

turnover number \ldots \text{(of an enzyme) not used; see catalytic-centre activity}

ultracentrifuge data \ldots \text{p. 4}

ultraviolet \ldots \text{u.v.}

uridine 3',5'-phosphate \ldots \text{cyclic UMP}

uridine 5'-phosphate \ldots \text{UMP}

uridine 5'-pyrophosphate \ldots \text{UDP}

uridine 5'-triphosphate \ldots \text{UTP}

variety (e.g. botanical) \ldots \text{var.}

velocity (symbol) \ldots \text{v}

Veronal \ldots \text{used only for buffer mixtures; otherwise use 5,5'-diethybarbituric acid}

viscosity, relative \ldots \eta_{rel} (\text{viscosity of solution}) (\text{viscosity of solvent})

viscosity, specific \ldots \eta_{sp.} (\text{i.e. } \eta_{rel} - 1)

viscosity, reduced \ldots \eta_{sp.}/c (\text{units: ml/g})

viscosity, intrinsic \ldots [\eta], \text{i.e. } \lim_{c \to 0} \eta_{sp.}/c

volt (m^2 \cdot \text{kg} \cdot \text{s}^{-3} \cdot \text{A}^{-1} = 1 \text{ A} \cdot \text{V}^{-1} = 1 \text{ J} \cdot \text{C}^{-1}) \ldots \text{V}

volume (abbreviation with number) \ldots \text{vol.}

v/v \ldots \text{used only for two components; by vol. used for three or more components}

watt (m^2 \cdot \text{kg} \cdot \text{s}^{-3} = \text{J} \cdot \text{s}^{-1}) \ldots \text{W}

wavelength \ldots \text{λ}

wavelength of D line of sodium (other wavelengths in nm) \ldots \text{D (as subscript)}

wavenumber (unit) \ldots \text{cm}^{-1}

weber \ldots \text{Wb}

weight \ldots \text{wt.}

xanthosine 5'-phosphate \ldots \text{XMP}

xanthosine 5'-pyrophosphate \ldots \text{XDP}

xanthosine 5'-triphosphate \ldots \text{XTP}