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Instructions to Authors. The *Policy of the Journal and Instructions to Authors* appeared in *Biochem. J.* (1983) **209**, 1–27. A summarized version appears in part 2 of each volume.

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1980	185–192	98.00	220.00	135.00	300.00
1981	193–200	120.00	260.00	160.00	360.00
1982	201–208	185.00	400.00	240.00	520.00

Complete run, 1967–1982 (107 volumes): £830.00 (U.S.$1850.00) to subscribers to printed journal; £1060 (U.S. $2550.00) to non-subscribers.
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Indexes. Volume indexes were discontinued at the beginning of 1981. Annual indexes will be supplied to subscribers as soon as possible after the end of each year.

Preliminary pages. Volume preliminary pages (previously supplied at the end of part 3 of each volume) were discontinued from volume 195. The preliminary pages in each issue have been rearranged and paginated so that they can be assembled to give a set of volume preliminary pages; page (i) is the volume title page supplied with part 1 of each volume.

THE BIOCHEMICAL JOURNAL

MOLECULAR ASPECTS

VOLUME 209 1983

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INDEX OF AUTHORS

	PAGE
Abuknesha, R.	265
Ahmed, K.	197
Anstee, D. J.	273
Antonini, E.	81
Avigliano, L.	167
Bailey, C. J.	151
Balber, A. E.	99
Basford, J. M.	243
Baudhuin, P.	159
Beesley, T.	229
Beynon, R. J.	251
Bhargava, P. M.	183
Bhat, P. G.	91
Bhoola, K. D.	125
Bond, J. S.	251
Brunori, M.	81, 175
Burley, R. W.	143
Chen, G.-X.	207
Christie, D. L.	51, 61
Colosimo, A.	81, 175
Comte, M.	269
Cox, J. A.	269
Danan, J.-L.	223
Das, M. R.	183
Davis, A. T.	197
Delfino, J. M.	107
Devos, P.	159
Fahim, R. E. F.	117
Fernández, H. N.	107
Fiedler, F.	125
Fielden, E. M.	167
Finazzi-Agró, A.	167
Forstner, G. G.	117
Forstner, J. F.	117
Fowler, C. J.	235
Gagnon, J.	51, 61
Galla, H.-J.	257
Gascoyne, N.	229
Gau, W.	125
Gietzen, K.	257
Glanville, R. W.	263
Gonias, S. L.	99
Goueli, S. A.	197
Griswold, M. D.	281
Grundström, T.	229
Grunnet, I.	215
Hawkes, T. R.	43, 207
Henkel, W.	263
Henschen, A.	125
Hers, H.-G.	159
Hirschauer, C.	125
Holder, A. A.	261
Hubbard, W. J.	99
Jacob, R. T.	91
Jaurin, B.	229
John, R. A.	243
Jones, E. D.	243
Jones, G. D.	175
Jones, M. G.	175
Kägi, J. H. R.	71
Katoh, N.	189
Keleti, T.	277
Khalfan, H.	265
Klauser, S.	71
Knott-Hunziker, V.	229
Knudsen, J.	215
Kragh-Hansen, U.	135
Kuo, J. F.	189
Lemon, M. J. C.	125
Leysath, G.	125
Lottspeich, F.	125
Lowe, D. J.	207
Mathieu, H.	223
Maulet, Y.	269
McCrodden, J. M.	235
O'Donnell, M. J.	207
O'Neill, P.	167
Pattabiraman, T. N.	91
Petursson, S.	229
Pizzo, S. V.	99
Qian, R.-G.	263
Reddy, E. P.	183
Reddy, E. S. P.	183
Ridgwell, K.	273
Robinson, D.	265
Sackmann, E.	257
Sarti, P.	81, 175
Scott, J. E.	263
Shannon, J. D.	251
Skinner, M. K.	281
Sleigh, R. W.	143
Smith, B. E.	43, 207
Strolin Benedetti, M.	235
Tanner, M. J. A.	273
Tipton, K. F.	235
Turner, A. J.	29
Turner, P. D.	151
Van Hoof, F.	159
Waley, S. G.	229
Whittle, S. R.	29
Wilson, K. J.	71
Wilson, M. T.	81, 175
Wise, B. C.	189
Xü, Y.-H.	257

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 p. 2, 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.

3. B.J. Letters. See page 3.

4. Reviews. See page 3.

This 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. In these matters for the *Biochemical Journal* the Editorial Manager and his deputy, the Editorial Secretary of the Journal, are 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 Secretary, Biochemical Journal, 7 Warwick Court, London WC1R 5DP, U.K.

The Editorial Board

Members of the Editorial Board are appointed by the Committee of the Society on the recommendation of the Editorial Board. The aim is to have a Board whose members have a wide experience of biochemical research. Two members are nominated by the British Biophysical Society.

Normally a paper is read by at least two people: either by two members of the Editorial Board, or, more usually, by a referee and a member of the Editorial Board. The referee is normally a member of the panel of Editorial Advisers, whose names will be printed in the Journal from time to time.

The main task of the editors and referees is to make recommendations on the acceptability of a paper. If rejection of a paper is recommended, or if there is any serious disagreement between those who have read the paper, the final decision is made by the Chairman or a Deputy Chairman. If a paper is considered to be acceptable in principle, requests for revision may be made by the editor (normally in the form of one or more Editorial Reports). At this stage the paper may also be partly prepared for press in the office before being returned to the author. This subediting process has no bearing on the decision by the editors on the acceptability of the paper. After revision by the author the paper is checked by a member of the Editorial Board before being finally prepared for press by the subeditors. In this final process attention is paid to grammar and the detailed conventions of the Journal.

The Editorial Board meets twice a year to discuss matters related to the production of the Journal. An Editorial Committee, consisting of the Chairman, Deputy Chairmen, three members of the Board, the Editorial Manager and the Editorial Secretary, meets more frequently to expedite the business of the Journal. The Board reports to the Committee of the Society, whose decision is required on financial matters, appointments or major aspects of policy.

The aim of the Editorial Board is to maintain a high

standard both of subject matter and of its presentation. Requests for revision range from minor matters to criticisms of the clarity or validity of statements or arguments.

Authors' replies to criticism or rejection will be sympathetically considered. Although editors and referees are normally anonymous, it is sometimes a help if direct discussion can take place between an author and an editor or a referee. This can be arranged, after consultation with the Chairman, if the author and the editor or referee consent.

INSTRUCTIONS TO AUTHORS

Submission of Papers

Submission of a paper to the Editorial Board 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 *Biochemical Journal* it will not be published elsewhere in the same form, either in English or in any other language, without the consent of the Editorial Board. The inclusion in a paper of material that has been wholly or largely published elsewhere will not be acceptable. This applies to tables and figures particularly. 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.

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 one month or if a significant amount of new material is added, 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 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** (normally one printed page maximum).
4. **Reviews** (usually solicited).

Publication delays can be minimized if authors prepare their papers in the form described below and 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. 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.

All papers that can be accommodated in four pages of the Journal will be treated as **Rapid Papers**. They receive priority reviewing and it is aimed for their publication to be within 12 weeks of receipt. In order to achieve this schedule, 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 Secretary 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.

Full-length Papers and Rapid Papers

Three copies of the typescript should be sent to the Editorial Secretary, The Biochemical Journal, 7 Warwick Court, London WC1R 5DP, U.K. The typescript should bear the name and address 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 by the Chairman. The top copy should be accompanied by the original artwork (see the Appendix to *Policy of the Journal and Instructions to Authors* 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.

The present division of the Journal into Molecular and Cellular Aspects will cease at the beginning of 1984. In the interim, however, authors should continue to indicate whether their paper is appropriate for Molecular or Cellular Aspects and in any case should state under which section in the Contents List their paper should appear:

Molecular Aspects (Physical, Structural and Chemical Properties of Biochemical Systems, including Sequencing Information)
Peptide and Protein Structure
Enzymes and Enzyme Kinetics
Metalloproteins
Gene Structure and Function
Lipids

Membranes
Carbohydrates and Complex Carbohydrates
Physical Biochemistry

Cellular Aspects (Biochemical Properties of Metabolic, Subcellular and Cellular Systems)
Protein Biosyntheis/Molecular Genetics
Protein Turnover
Metabolism, Regulation and Control Processes
Cell Surfaces and Receptors
Developmental Biochemistry
Membranes, Transport, Bioenergetics and Photosynthesis

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 should be in double-spaced typing throughout (including the references and legends of tables and figures) on sheets of uniform size with wide margins.

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.

It is helpful if the author encloses 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 important that the author should include photo-copies of the relevant typescript together with documentary evidence that it has been accepted for publication. 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 title of up to 60 letters and spaces should also be given (for Full Papers and Reviews only).

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 materials 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 5500 words in length, and Rapid Papers must not exceed 2400 words, each inclusive of title 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 700 words per full page of the Journal.

B.J. Letters

'B.J. 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 should be addressed to the Editorial Secretary. Typescripts should be submitted in triplicate, written in English using the spellings and abbreviations that are approved by the Journal. No synopsis is required. Normally B.J. Letters should not exceed 700 words in length, which is approximately the equivalent of one printed page. One Scheme, Table or Figure may be included if this is essential, but the preparation of these is likely to increase publication time. 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.

Reviews

Biochemical Journal 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.

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All communications about reprints should be addressed to the Executive Secretary. The Biochemical Society, 7 Warwick Court, London WC1R 5DP.

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

NOTES ON THE PREPARATION OF PAPERS

Acknowledgments	4
Animals	4
Centrifuging	4
Chromatography	4
Deposition of data	5
Dialysis	5
Electrophoresis	5
Enzymes	5
Ethics of human experimentation	6
Experimental hazards	6
Footnotes	6
Illustrations	6
Isotope experiments	7
Mass spectrometry	7
Micro-organisms	7
Nucleic acid sequence data	7
Plants	7
Powers in tables and figures	7
Prefixes for multiples and submultiples of units	8
References	8
Solutions	8
Spectra and spectroscopic data	9
Statistical treatment of results	10
Symbols for physical units	10
Tables	10
Trade names	10

For nomenclature please refer to the separate section on pp. 11–16, or, for specialized problems, the relevant documents listed there.

The *Biochemical Journal* uses as a standard for spelling the *Concise Oxford Dictionary of Current English* (Clarendon Press, Oxford). For the technique of writing, authors may find it helpful also to consult *The Complete Plain Words*, by Sir Ernest Gowers (H.M.S.O. and Penguin Books, London) and *Writing a Scientific Paper* by V. Booth (5th edition; The Biochemical Society, London).

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.

Acknowledgments

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.

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 $\boldsymbol{g}$ (as defined on p. 19), based on the average radius of rotation of the liquid. For example: 'The rotor was operated for 15 min at 2°C and 10000$\boldsymbol{g}$ ($r_{av.}$ 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 $\boldsymbol{g}$) for the average radius of rotation ($r_{av.}$) of the column of liquid in the rotor. For example: 'The rotor was operated at 5°C. The integrated field-time was 250000$\boldsymbol{g}$-min at $r_{av.}$ 6.5 cm' [i.e. $(r_{av.}/g)\int_0^t \omega^2 \cdot dt = 250000$ (at $r_{av.}$ 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 to 20°C in water, $s_{20,w}$; sedimentation coefficient at zero concentration, s^0, $s^0_{20,w}$; Svedberg unit (10^{-13} s), S; partial specific volume, $\bar{v}$; diffusion coefficient, D, D^0, $D_{20,w}$ etc. as for sedimentation coefficient. The temperature at which the sedimentation and diffusion measurements are made should be stated.

Chromatography

Photographs of 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 (α or K_D). The course of any eluent gradients used should be indicated clearly.

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 will be subject to editing in the normal manner before being accepted for deposition. (It should be noted, however, that the Editorial Board cannot accept the responsibility of checking the accuracy of computer programs.) 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: 33cm × 24cm.

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

(*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. If the authors have the facilities available, the use of a type-face designed to be 'read' by computers is encouraged.

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-diffusable 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 nomenclature

The recommendations of the latest edition of *Enzyme Nomenclature* [(1978) Academic Press, London and New York] and its Supplements will be followed as far as possible. This includes the quoting of EC numbers.

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 *Enzyme Nomenclature* (1978)]. Units of the amount of enzyme may, however, be expressed in terms of the amount that can catalyse other rates, e.g. 1 μmol 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 for A. K_s is the equilibrium constant of the dissociation of the substrate–enzyme complex.

Ethics of Human Experimentation

The Editorial Board agrees with the principles laid down in the Declaration of Helsinki (1964) [*Br. Med. J.* (1964) **ii**, 177–178; see also Report of the Medical Research Council for 1962–63, pp. 21–25]. Authors should ensure that their work complies with these declarations. 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.

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. The potential dangers involved in the use of pathogens or in the manipulation of the genetic composition of micro-organisms were considered in three reports: (*a*) Report of the Working Party on the Laboratory Use of Dangerous Pathogens (Chairman, Sir George Godber; H.M.S.O., London, May 1975, Command No. 6054); (*b*) Report of the Working Party on the Experimental Manipulation of the Genetic Composition of Microorganisms (Chairman, Lord Ashby; H.M.S.O., London, January 1975, Command No. 5880); (*c*) Report of the Working Party on the Practice of Genetic Manipulation (Chairman, Sir Robert Williams; H.M.S.O., London, August 1976, Command No. 6600).

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. Illustration 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, which should be underlined, and an explanatory legend, starting on a new line. 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 that there is no ambiguity.

Reproduction of 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. Authors are referred to the Appendix (pp. 24–27) for full details. Line diagrams that are submitted in a form unsuitable for direct reproduction, for any reason, will be returned to the author or redrawn by the printer's draughtsman, with consequent delay.

Reproduction of half-tone illustrations (photographs)

Plates on art paper are used only for the reproduction of half-tone illustrations such as electron micrographs etc. Glossy prints are required for these. It is helpful if the prints supplied are trimmed to the intended reproduction size (i.e. to fit within the Plate area). Where the magnification is to be indicated (e.g. on electron micrographs), this is best done by adding a bar representing a stated length.

The editors will accept Plates for publication only (*a*) when they make a sufficiently important scientific contribution to the paper and (*b*) when the photographs supplied are of a quality that justifies publication in this form.

Thus photographs of electrophoretograms, radioautograms etc., for example, will normally be reproduced as half-tone figures on text paper. If it is not possible to obtain photographs of the required quality, such illustrations can often be replaced by tracings for reproduction as line diagrams.

Isotope Experiments

The information given should include: (*a*) sufficient details of the method of assay to allow an estimate of the efficiency of detection (preferably an assay of a standard under the same conditions); (*b*) details of corrections made to the observed count rate; (*c*) standard error of the results or a statement of the total counts above background collected; (*d*) in general the specific activity of the starting and final materials should be given, preferably in terms of curies per unit weight or, for stable isotopes, as atoms % excess. For some purposes the count rate under defined conditions such as at infinite thickness is satisfactory, but authors should consider any limitations that such statements may impose on the deductions from their work.

In assessment of the specific activities of starting materials, dilution with unlabelled materials in the incubation mixture should be allowed for. This is not always possible, but, unless the dilution is known, the radioactivity measurements do not indicate the amount of material transferred.

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

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 ($M^+ - H_2O$) 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. Eubacteriales, Lactobacilleae), generic names used adjectivally (e.g. 'staphylococcal') 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.

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.

Authors are urged to offer new organisms to collections of micro-organisms so that they may be readily available to other workers.

Reference books

Bergey's *Manual of Determinative Bacteriology*, Baillière, Tindall and Cox, London. *A Dictionary of the Fungi* by G. C. Ainsworth & G. R. Bisby, Imperial Mycological Institute, Kew. *The Yeasts: a Taxonomic Study* by J. Lodder & N. J. W. Kreger van Rij, North-Holland, Amsterdam.

Nucleic Acid Sequence Data

Authors submitting nucleic acid sequence data are requested to do so in a form compatible with the Guidelines suggested by the European Molecular Biology Laboratory, which will enable the Laboratory to add the sequence quickly and accurately to its data bank. The main suggestion in the Guidelines is that whatever the form in which the sequence may appear in the Journal, a 'clean' copy of the sequence should be submitted with the manuscript by the authors. This copy should not be reduced, should contain no comparative sequences or translation products, should be in block form, and with the size, source and genetic location of the sequence given as precisely as possible. Copies of the Guidelines are available on request from the Editorial Office.

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 10^3k means that the value of k is 0.002; and entry '2' under heading $10^{-3}k$ means that the value of k is 2000; (ii) a concentration 0.000 15 M may be expressed as 0.15 under heading 'concn. (mM)' *or* as 150 under heading 'concn. (μM)' *or* as 15 under heading '$10^5 \times$ concn. (M)', but *not* as 15 under heading 'concn. ($M \times 10^{-5}$)'; (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:

Multiple	Prefix	Symbol
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^2	hecto	h*
10	deka	da*
10^{-1}	deci	d*
10^{-2}	centi	c*
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

* 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, not the Numbering System, should be used for the citation of references in the text, as follows: for papers written by one or two 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 authors has appeared in one year the references should be given as 'Lowe & Yuthavong (1971*a,b*)' or '(Slater & Sawyer, 1969, 1971*a,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.

Krebs, H. A. (1961) *Biochem. J.* **80**, 225–233

Krebs, H. A. & Lund, P. (1966) *Biochem. J.* **98**, 210–214

Krebs, H. A. & Woodford, M. (1965) *Biochem. J.* **94**, 436–445

Krebs, H. A., Speake, R. N. & Hems, R. (1965) *Biochem. J.* **94**, 712–720

Krebs, H. A., Freedland, R. A., Hems, R. & Stubbs, M. (1969) *Biochem. J.* **112**, 117–124

It should be noted that 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* (*1907–1974 Cumulative*) (1975) and subsequent Quarterly Supplements (American Chemical Society).

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

Dixon, M. & Webb, E. C. (1964) *Enzymes*, 2nd edn., p. 565, Longmans Green, London

Kirby, K. S. (1967) in *Techniques in Protein Biosynthesis* (Campbell, P. N. & Sargent, J. R., eds.), vol. 1, pp. 265–297, Academic Press, London and New York

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

Smith, A. (1983) *Biochem. J.* in the press

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 the 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_2PO_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 trivial names such as Hepes [4-(2-hydroxyethyl)-1-piperzine-ethanesulphonic acid], which should be defined in a footnote.

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 (I_0/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 $A^{1\%}_{1cm}$); 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·cm^{-1} and not cm^2·mol^{-1}). Wavelengths are given (in nm) as subscripts without units, e.g. $A^{1\%}_{1cm,420}$. 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, $[\alpha]^t_\lambda$, 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. '$[\alpha]^{20}_{420}$ −27.5 (*c* 2 in methanol)'.

The corresponding molar expressions for the molar rotation, $[M] = [\alpha] \times$ molecular weight and $[m] = [\alpha] \times$ molecular weight/100 should be defined.

For biopolymers the mean residue molecular weight is used, and $[m]$ is the mean residue rotation. Where a refractive-index correction is applied, $[m']$, the reduced mean residue rotation, is reported. Dimensions of $[m]$ and $[m']$ are degrees·cm^2·$dmol^{-1}$.

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

Circular dichroism

This is reported as the molar circular-dichroism absorption coefficient $\Delta\varepsilon = \varepsilon_L - \varepsilon_R$ [or the molar ellipticity, $[\theta]$ (see below)]. For biopolymers, molar concentrations in terms of the mean residue molecular weight are generally used. Units of Δε are the same as for ε, i.e. litre·mol^{-1}·cm^{-1} or M·cm^{-1}.

Specific ellipticity $[\psi]$, molar ellipticity $[\theta]_M$ and

mean residue ellipticity $[\theta]_{m.r.w.}$ are directly analogus to the terms used in optical rotation. The units of $[\theta]$ are as for $[m]$. Note that $[\theta]_M = 3300 \times \Delta\varepsilon$.

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.) [(^{2}H)chloroform] 0.92 [6H, d, J 6Hz. $CH(CH_3)$], 2.16 (2H, t, J 7Hz, CH_2CH_2CO)'. Singlet, 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 290K). 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 ± 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 '42kJ/mol' or '42kJ/mol (10kcal/mol)', is permissible, but not '10kcal/mol' alone. Details are given below under 'Abbreviations, Symbols, Conventions and Definitions' (pp. 17–23). 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. 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/100ml, 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 appartus or materials should be given, and also their addresses. Wherever possible, the chemical nature of the proprietary material should be specified at the first mention.

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.

1. Abbreviations and symbols for chemical names of special interest in biological chemistry: *Biochem. J.* (1966) **101**, 1–7 (extended by items 7 and 11 below).
2. Trivial names of compounds of importance in biochemistry; nomenclature and symbols for folic acid and related compounds: *Biochem. J.* (1967) **102**, 15–22 (but see items 14, 29, 32 and 35 below).
3. Rules for naming synthetic modifications of natural peptides: *Biochem. J.* (1967) **104**, 17–19 [for amendments see *Biochem. J.* (1973) **135**, 9].
4. The nomenclature of lipids: *Biochem. J.* (1978) **171**, 21–35.
5. A one-letter notation for amino acid sequences: *Biochem. J.* (1969) **113**, 1–4.
6. The nomenclature of steroids: *Biochem. J.* (1969) **113**, 5–28 [for amendments see *Biochem. J.* (1972) **127**, 613–617].
7. Abbreviations and symbols for nucleic acids, polynucleotides and their constituents: *Biochem. J.* (1970) **120**, 449–454 (replaces section 5 of item 1 above).
8. Abbreviations and symbols for the description of the conformation of polypeptide chains: *Biochem. J.* (1971) **121**, 577–585.
9. Tentative rules for carbohydrate nomenclature, part 1: *Biochem. J.* (1971) **125**, 673–695.
10. The nomenclature of multiple forms of enzymes: *Biochem. J.* (1978) **171**, 37–39.
11. Symbols for amino acid derivatives and peptides: *Biochem. J.* (1972) **126**, 773–780 [for corrections see *Biochem. J.* (1973) **135**, 9] (replaces section 2 of item 1 above).
12. Tentative rules for the nomenclature of carotenoids: *Biochem. J.* (1972) **127**, 741–752 [for amendments see *Biochem. J.* (1975) **151**, 5–7].
13. Abbreviated nomenclature of synthetic polypeptides (polymerized amino acids): *Biochem. J.* (1972) **127**, 753–756.
14. Nomenclature for vitamins B-6 and related compounds: *Biochem. J.* (1974) **137**, 417–421 (replaces M-7 of item 2 above.
15. Recommendations for the nomenclature of human immunoglobulins: *Biochem. J.* (1975) **145**, 21–23.
16. The nomenclature of corrinoids: *Biochem. J.* (1975) **147**, 1–10.
17. Nomenclature of quinones with isoprenoid side chains: *Biochem. J.* (1975) **147**, 15–21.
18. Nomenclature of α-amino acids; *Biochem. J.* (1975) **149**, 1–16.
19. The nomenclature of peptide hormones: *Biochem. J.* (1975) **151**, 1–4.
20. Nomenclature of cyclitols: *Biochem. J.* (1976) **153**, 23–31.
21. Recommendations for measurement and presentation of biochemical equilibrium data: *Biochem. J.* (1977) **163**, 1–7.
22. Nomenclature of phosphorus-containing compounds of biochemical importance: *Biochem. J.* (1978) **171**, 1–19.
23. Nomenclature of iron–sulphur proteins: *Biochem. J.* (1979) **181**, 513–516.
24. Units of enzyme activity: *Eur. J. Biochem.* (1979) **97**, 319–320 [see also correction *Eur. J. Biochem.* (1980) **104**, 1].
25. Nomenclature of tetrapyrroles: *Eur. J. Biochem.* (1980) **108**, 1–30.
26. Conformation of 5- and 6-membered ring forms of sugars: *Eur. J. Biochem.* (1980) **111**, 295–298.
27. Nomenclature of unsaturated monosaccharides: *Eur. J. Biochem.* (1981) **119**, 1–3 [for corrections see *Eur. J. Biochem.* (1982) **125**, 1].
28. Nomenclature of branched-chain monosaccharides: *Eur. J. Biochem.* (1981) **119**, 5–8 [for corrections see *Eur. J. Biochem.* (1982) **125**, 1].
29. Nomenclature of tocopherols and related compounds: *Eur. J. Biochem.* (1982) **123**, 473–475 (supersedes M-3 of item 2 above).
30. Abbreviated terminology of oligosaccharide chains: *J. Biol. Chem.* (1982) **257**, 3347–3351.
31. Polysaccharide nomenclature: *J. Biol. Chem.* (1982) **257**, 3352–3354.
32. Nomenclature of vitamin D: *Eur. J. Biochem.* (1982) **124**, 223–227 (supersedes M-2 of item 2 above).
33. Symbols for specifying the conformation of polysaccharide chains: *Eur. J. Biochem.* (1983), in the press
34. Symbols for specifying the conformation of polynucleotide chains: *Eur. J. Biochem.* (1983), in the press
35. Retinoid nomenclature: *Eur. J. Biochem.* (1982) **129**, 1–5 (supersedes M-1 of item 2 above).
36. Symbolism and terminology in enzyme kinetics: *Eur. J. Biochem.* (1982) **128**, 281–291

Copies of *The Compendium of Biochemical Nomenclature and Related Documents* (1978, 3rd edn.) are obtainable from the Biochemical Society Book Dept, P.O. Box 32, Commerce Way, Colchester CO2 8HP, Essex, U.K. (price £3.50. US$7.00, postage paid). Comments on the Recommendations should be sent to the Nomenclature Committee of IUB (Secretary: A. Cornish-Bowden, Department of Biochemistry, University of Birmingham, P.O. Box 363, Birmingham B15 2TT, U.K.).

Abbreviations

The *Biochemical Journal* in general follows the Recommendations 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 ones, e.g. Me, Et, Ph, Ac). Abbreviations may be used in the title where necessary to avoid unwieldiness. Non-standard abbreviations should also not normally be used in the synopsis, in text subheadings and in titles to tables, figures, schemes and plates. 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 parts of chemical names are preferred (e.g. Me_2 for DM, H_4 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. Thus 'turnip yellow-mosaic virus' may be abbreviated to 'TYM virus' but not to 'TYMV', and 'poly(XY)' should not be 'PXY'. Cumbersome names 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	5′-Pyrophosphates of adenosine, cytidine, guanosine, inosine, uridine, xanthosine, thymidine
AMP etc.	Adenosine 5′-phosphate etc.
ATP etc.	Adenosine 5′-triphosphate etc.
ATPase	Adenosine triphosphatase
CM-cellulose	Carboxymethylcellulose
CoA and acyl-CoA	Coenzyme A and its acyl derivatives
cyclic AMP etc.	Adenosine 3′,5′-phosphate etc.
DEAE-cellulose	Diethylaminoethylcellulose
DNA	Deoxyribonucleic acid
EDTA	Ethylenediaminetetra-acetate
EGTA	$(HO_2C{-}CH_2)_2N{-}[CH_2]_2{-}O{-}[CH_2]_2{-}O{-}[CH_2]_2{-}N(CH_2{-}CO_2H)_2$ ['ethyleneglycolbis (aminoethylether)tetra-acetate']
FAD	Flavin–adenine dinucleotide
FMN	Flavin mononucleotide
NAD*	Nicotinamide–adenine dinucleotide
NADP*	Nicotinamide–adenine dinucleotide phosphate
NMN	Nicotinamide mononucleotide
P_i, PP_i	Orthophosphate, pyrophosphate
RNA, mRNA, nRNA, rRNA, tRNA†	Ribonucleic acid and messenger, nuclear, ribosomal and transfer ribonucleic acid species
Tris	2-Amino-2-hydroxymethyl-propane-1,3-diol

* Oxidized and reduced forms of the dinucleotides should be indicated as, for example, *either* NAD^+, NADH, or NAD, $NADH_2$, *not* NAD, NADH. The NAD^+, NADH form is preferred and has the advantage that NAD can be used when the state of oxidation need not be indicated.

† Specific tRNA species should be given as, for example, alanine tRNA or $tRNA^{Ala}$; tRNA bound to amino acid should be given, as for example, alanyl-tRNA or alanyl-$tRNA^{Ala}$ (note: fMet = formylmethionyl). sRNA should not be used.

Symbols for amino acids [*see Biochem. J.* (1972) **126**, 773–780, *and Biochem. J.* (1975) **149**, 1–16]

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

Ala	Alanine
Arg	Arginine
Asn	Asparagine
Asp	Aspartic acid
Asx	Aspartic acid or asparagine (undefined)
Cys	Cysteine
Cys or Cys (with bond bar above / below)	Cystine (half)
Gln	Glutamine
Glu	Glutamic acid
Glx	Glutamic acid or glutamine (undefined)
Gly	Glycine
His	Histidine
Hyl	Hydroxylysine
Hyp	Hydroxyproline
Ile	Isoleucine
Leu	Leucine
Lys	Lysine

Met	Methionine
Orn	Ornithine
Phe	Phenylalanine
Pro	Proline
Ser	Serine
Thr	Threonine
Trp	Tryptophan
Tyr	Tyrosine
Val	Valine

Others are listed in *Biochem. J.* (1972) **126**, 773–780.

In polymers or sequences the 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. Further details are given in *Biochem. J.* (1972) **127**, 753–756. 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*)]

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

A	Adenosine	C	Cytidine
G	Guanosine	T	Ribosylthymine
I	Inosine	U	Uridine
X	Xanthosine	Ψ	5-Ribosyluracil (pseudouridine)

General symbols:

R	Unspecified purine nucleoside
Y	Unspecified pyrimidine nucleoside
N	Unspecified nucleoside (*not* X)

The 2′-deoxyribonucleosides are designated by the same symbols preceded by d, e.g.:

dA	2′-Deoxyribosyladenine
dT	2′-Deoxyribosylthymine (thymidine)

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.:

pA-G	5′-Phosphoadenylyl(3′-5′)-guanosine *or* guanylyl(5′-3′)-adenosine 5′-phosphate
A-Gp	Adenylyl(3′-5′)guanosine 3′-phosphate
d(A-T)	Deoxyadenylyl(3′-5′)thymidine
A-G-cyclic-p *or* A-G > p	Adenylyl(3′-5′)guanosine 2′,3′-phosphate

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

A2′-5′G2′p	Adenylyl(2′-5′)guanosine 2′-phosphate
A-G-(mixed 2′,3′)-p	A mixture of A-Gp and 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.:

G-A-U(C_2,U)Gp

indicates a heptanucleotide composed of three nucleotides of known sequence but with a trinucleotide of unknown sequence before the final Gp. In the special case of triplet codons the hyphens may be omitted, e.g. UUU.

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(A_3,C_2)	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
poly(A,G,C,U)	random co-polymer of A, G, C and U, proportions unspecified

The prefix co-poly or oligo may replace poly, if desired. An alternative form is, e.g., A_n 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 no space follows 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 unknown association by a comma; e.g.:

poly(A)·poly(U)*	associated poly(A) and poly(U)
poly(G)·2poly(C) *or* G_n·2C_n	triple-stranded complex of poly(G) and poly(C) in the proportions 1:2
poly(dA-dC)·poly-(dG-dT) *or* (dA-dC)$_n$·(dG-dT)$_n$	associated poly(dA-dC) and poly(dG-dT)

* Also 'adenine·thymine base pair' or 'A·T base pair' in the text.

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

† Also 'A + T content' (and 'A-T sequence'), not 'AT content' (nor 'AT sequence'), in the text.

Symbols for sugars [*see Biochem. J.* (1978) **171**, 34, *and Eur. J. Biochem.* (1982) **126**, 433–437]

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

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

* Similarly for other 2-deoxy sugars.

† Where no ambiguity can arise, the single-letter symbol G may be used, but is not preferred.

When it is necessary to indicate furanose or pyranose, the letter *f* or *p* after the saccharide symbol may be used: e.g. Rib*f* for ribofuranose.

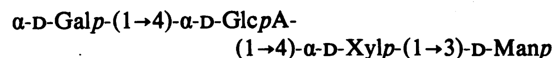
The following suffixes may be used, also without definition, to indicate derivatives:

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)

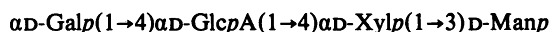
Note: NeuAc or AcNeu suffices for *N*-acetylneuraminate [see *Biochem. J.* (1978) **171**, 34].

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

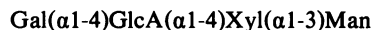
In the extended system the configurational symbol (D or L) is included before the symbol for the monosaccharide, and is separated therefrom by a hyphen. The anomeric symbol (α or *β*) is included before the configurational symbol and separated therefrom by a hyphen. Between the symbol (abbreviated name) 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:


α-D-Gal*p*-(1→4)-α-D-Glc*p*A-(1→4)-α-D-Xyl*p*-(1→3)-D-Man*p*

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


αD-Gal*p*(1→4)αD-Glc*p*A(1→4)αD-Xyl*p*(1→3)D-Man*p*

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 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:


Gal(α1-4)GlcA(α1-4)Xyl(α1-3)Man

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].
2. Nomenclature of organic chemistry: Sections A, B, C, D, E, F and H [1978 edn. (1979) Pergamon Press, Oxford].
3. Manual of symbols and terminology for physicochemical quantities and units [revised edn. (1979) Pergamon Press, Oxford].
4. IUPAC compendium of analytical nomenclature: 'The orange book' [(1978) Pergamon Press, Oxford]

[Copies of the *IUPAC Information Bulletin* and Appendices are available from the IUPAC Secretariat, 2–3 Pound Way, Cowley Centre, Oxford OX4 3YF, U.K.]

Elementary analyses and physical properties

Standard forms for reporting these are as follows.

The *new compound* (name in italics) had m.p. 175°C (decomp.), $[\alpha]_D^{22} + 17 \pm 2°$ (*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; $C_8H_{16}N_2O_6$ 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 $C_{10}H_{16}O_7$: 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 $C_{28}H_{22}I_2N_2,2H_2O$: C, 49.7; H, 3.9; N, 4.2; H_2O, 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), n_D^{16} 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.

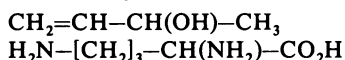
Melting points. It is desirable to state whether these are corrected or uncorrected for the emergent stem of the thermometer.

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.:



$$CH_2{=}CH{-}CH(OH){-}CH_3$$
$$H_2N{-}[CH_2]_3{-}CH(NH_2){-}CO_2H$$

Formulae 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^1, R^2, R^3, R^4 if more than three) should be used to denote variable substituents in formulae.

C_{20} acid is used to denote an acid containing 20 carbon atoms and C-3 or $C_{(3)}$ to denote the carbon atom numbered 3. $C_{18:0}$, $C_{18:1}$ etc. are used similarly to denote the number of double bonds in an unsaturated fatty acid.

Ions

These should be represented thus: Na^+, Zn^{2+}, Cl^-, PO_4^{3-}.

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 [^{14}C]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 [$^{14}C_2$]glycollic acid. The symbol 'U' indicates uniform and 'G' general labelling, e.g. [U-^{14}C]glucose (where the ^{14}C is uniformly distributed among all six positions) and [G-^{14}C]glucose (where the ^{14}C is distributed among all six positions, but not necessarily uniformly); in the latter case it is often sufficient to write simply '[^{14}C]glucose'.

The isotopic prefix precedes that part of the name to which it refers, as in sodium [^{14}C]formate, iodo-[$^{14}C_2$]acetic acid, 1-amino[^{14}C]methylcyclopentanol ($H_2N{-}^{14}CH_2{-}C_5H_8{-}OH$), α-naphth[^{14}C]oic acid ($C_{10}H_7{-}^{14}CO_2H$), 2-acetamido-7-[^{131}I]iodofluorene, fructose 1,6-[1-^{32}P]bisphosphate, D-[^{14}C]glucose, 2*H*-[2-^{2}H]pyran, *S*-[8-^{14}C]adenosyl[^{35}S]methionine. Terms such as '^{131}I-labelled albumin' should not be contracted to '[^{131}I]albumin' [since native albumin does not contain iodine (but ^{131}I-albumin can be used)], and '^{14}C-labelled amino acids' should similarly not be written as '[^{14}C]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 ^{2}H and ^{3}H 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-^{2}H]ethanol ($CH_3{-}C^2H_2{-}OH$), [1-^{14}C]aniline, L-[2-^{14}C]leucine (or L-[α-^{14}C]leucine), [*carboxy*-^{14}C]leucine, [*Me*-^{14}C]isoleucine, [2,3-^{14}C]maleic anhydride, [6,7-^{14}C]xanthopterin, [3,4-^{13}C,^{35}S]methionine, [2-^{13}C,1-^{14}C]acetaldehyde, [3-^{14}C,2,3-^{2}H,^{15}N]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-^{32}P]ATP.

For simple molecules, however, it is often sufficient to indicate the labelling by writing the chemical formulae, e.g. $^{14}CO_2$, $H_2{}^{18}O$, ^2H_2O (not D_2O), $H_2{}^{35}SO_4$, 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. '^{131}I-labelled').

Naming compounds

All chemical names are run together except for those of acids, acetals, esters, ethers, glycosides,

ketones and salts, which are printed as separate words: hyphens are used to separate numbers, Greek letters or some configurational and italic prefixes from words, e.g. *m*-dinitrobenzene, *ββ*-dimethyl-D-cysteine, 2-*p*-isopropylphenylheptane, ethyl methyl ketone (butan-2-one).

Optically active isomers

Names of chiral compounds whose absolute configuration is known may be differentiated by the prefixes *R*- and *S*- [see *Pure Appl. Chem.* (1976) **45**, 11–30]. When the compounds can be correlated sterically with glyceraldehyde, serine or other standard accepted for a specialized class of compound, small capital letters D-, L- and DL- may be used for chiral compounds and their racemates. Where the direction of optical rotation is all that can be specified, (+)-, (−)- and (±)-, or *dextro*, *laevo* and 'optically inactive', are used.

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].

Prefixes

Italics are used for certain prefixes, e.g. *cis*-, *trans*-, *o*-, *m*-, *p*-, *dextro*, *laevo*, *meso*, and also for *O*-, *N*- etc. to indicate an element carrying a substituent, e.g. N^4-acetylsulphanilamide. Italics are not used for allo, bis, cyclo, epi, iso, neo, nor, tris.

An alphabetical order will be followed for prefixes denoting substituents. Syllables indicating multiple substituents, e.g. di-, tri-, do not count in deciding the order.

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. 11–16).

Term	Symbol / abbreviation / definition
abbreviations	pp. 12–14
absorbance	$A = \log(I_0/I)$ (*see* p. 9)
absorption coefficient molar	ε (*see* p. 9)
acceleration due to gravity ($9.81\,m\cdot s^{-2}$)	g (*see* p. 4)
adenosine 3′,5′-phosphate	cyclic AMP
adenosine 5′-phosphate	AMP
adenosine 5′-pyrophosphate	ADP
adenosine triphosphatase	ATPase
adenosine 5′-triphosphate	ATP; the three phosphorus atoms are distinguished as α, β and γ, thus: adenosine-P^{α}–O–P^{β}–O–P^{γ}
alternating current	a.c.
amino acids, symbols for	pp. 12–13
2-amino-2-hydroxymethylpropane-1,3-diol	Tris
ampere	A
angström	Å (*use* SI units: 1 Å = 0.1 nm)
approximately	approx. (*or use* about, *not c. or ca.*)
aqueous	aq.
ascorbic acid	*alternative permitted* vitamin C
atmosphere	atm (*use* SI units: 1 atm = 101 325 Pa)
atomic weight	at.wt.
atto ($10^{-18}\times$)	a (prefix)
bar (pressure)	bar (*use* SI units: 1 bar = 10^5 Pa)
barn ($10^{-28}m^2$)	b
becquerel (s^{-1})	Bq
boiling point	b.p.
buffers	p. 9
calciferol	*use* ergocalciferol or ercalciol, *alternative permitted* vitamin D_2
calculated	calc.
*calorie, I.T.	cal_{IT} (*use* SI units: 1 cal_{IT} = 4.1868 J)
*calorie, thermochemical	cal_{th} (*use* SI units: 1 cal_{th} = 4.184 J)
candela	cd
capric acid	*use* decanoic acid
caproic acid	*use* hexanoic acid
caproyl	*use* hexanoyl
capryl, caprinoyl	*use* decanoyl
caprylic acid	*use* octanoic acid
caprylyl, capryloyl	*use* octanyl
carbobenzoxy	*use* benzyloxycarbonyl
carboxymethylcellulose	CM-cellulose
catalytic-centre activity	number of molecules of substrate transformed/s per catalytic centre
centi ($10^{-2}\times$)	c (prefix) (*see* p. 8)
centimetre	cm
centimetre gram(me) second	c.g.s.
centrifuging	p. 4
cholecalciferol	*alternative permitted* calciol or vitamin D_3
chromatography	pp. 4–5
circular dichroism (*see also* ellipticity)	c.d. ($\Delta\varepsilon$) (*see* pp. 9–10)
cocarboxylase	*use* thiamin pyrophosphate
coefficient of variation	standard deviation/mean value (*see* p. 10)

* The symbol 'cal' may be used where the degree of accuracy does not justify distinction between cal_{IT} and cal_{th}.

Term	Abbreviation / usage
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*
constant, velocity	*k* (*see* p. 6)
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. mm^3
curie ($3.7\times10^{10}s^{-1}$)	Ci
cycles per second	Hz
cytidine 5-phosphate	CMP
cytidine 5′-pyrophosphate	CDP
cytidine 5′-triphosphate	CTP
dalton ($\frac{1}{12}$ of the mass of one atom of nuclide ^{12}C, i.e. $1.663\times10^{-24}g$)	Da; alternative name for the atomic mass unit [it may be used for molecular mass, but not for relative molecular mass (molecular weight), which is a dimensionless number]
data (N.B.: plural)	*use only* in the sense of 'information given'
data, deposition of	p. 5
deci ($10^{-1}\times$)	d (prefix) (*see* p. 8)
decomposition (m.p.)	decomp.
degrees Celsius (t/°C = T/K − 273.15)	°C
degrees Kelvin	K (*not* °K)
deka (10×)	da (prefix) (*see* p. 8)
density	ρ (g/ml)
density, relative	*d*
deoxy (prefix)	*not* desoxy; symbol d
deoxyribonuclease	DNAase (to be defined in a footnote)

Term	Abbreviation / usage
deoxyribonucleic acid	DNA
deoxyribonucleosides, symbols for	p. 13
dialysable	*not permitted*; *use* diffusible (*see* p. 5)
dialysate	*not used*; *for* diffusible material *use* diffusate (*see* p. 5)
diethylaminoethylcellulose	DEAE-cellulose
diffusion coefficient	D, D^0, $D_{20,w}$ etc. (*as for* sedimentation coefficient) (*see* p. 4)
dilute	dil.
5-dimethylaminonaphthalene-1-sulphonyl-	Dns- *or* dansyl- (to be defined in a footnote)
2,4-dinitrophenyl-	Dnp- *or* N_2ph- (to be defined in a footnote)
direct current	d.c.
disintegrations/min, disintegrations/s	d.p.m., d.p.s.
dissociation constant, minus log of	p*K*, *plural* p*K* values
disulphide group	*alternative permitted* S–S
dithionite (sodium)	$Na_2S_2O_4$, *not* hydrosulphite, hyposulphite
dry ice	*use* solid CO_2
dyne	dyn (*use* SI units: 1 dyn = 10^{-5}N)
electrode potential, standard	E_0
electrode potential, standard at given pH	E'_0
electromotive force	e.m.f.
electron spin resonance, electron paramagnetic resonance	e.s.r., e.p.r.
electronvolt ($\approx1.6022\times10^{-19}$J)	eV
electrophoretic mobility ($m^2\cdot s^{-1}\cdot V^{-1}$)	*m* (*see* p. 5)
elementary analyses	pp. 14–15
ellipticity (*see also* circular dichroism)	$[\theta] = 3300\,\Delta\varepsilon$ (*see* pp. 9–10)

Term	Abbreviation / usage
enthalpy (change)	ΔH ($kJ \cdot mol^{-1}$)
entropy (change)	ΔS ($kJ \cdot mol^{-1} \cdot K^{-1}$) (*not* e.u.)
enzyme units	p. 5
equation	eqn.
equivalent (weight) . . .	equiv. (wt.)
erg	erg (*use* SI units: 1 erg = 10^{-7} J)
ethanol, ethanolic	*not* ethyl alcohol, *not* alcoholic
ethylenediaminetetra-acetate	EDTA
'ethyleneglycolbis(amino-ethylether)tetra-acetate' $(HO_2C{-}CH_2)_2N{-}[CH_2]_2{-}O{-}[CH_2]_2{-}O{-}[CH_2]_2{-}N(CH_2{-}CO_2H)_2$ . . .	EGTA
experiment (with reference numeral)	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
fatty acids	p. 15
femto (10^{-5} ×)	f (prefix)
figure (with reference numeral)	Fig; *plural* Figs.
figures, preparation of . .	pp. 6, 24–27
flavin–adenine dinucleotide	FAD
flavin mononucleotide . .	FMN
fluorescence anisotropy .	A (*see* p. 10)
fluorescence polarization .	P (*see* p. 10)
folates	*see Biochem. J.* (1967) **102**, 19–20
foot	ft (*use* SI units: 1 ft = 0.3048 m)
foot-candle	ft-candle (*use* SI units: 1 ft-candle = 10.7639 lx)
formulae	p. 15
free energy (Gibbs) (change)	ΔG ($kJ \cdot mol^{-1}$)
frictional coefficient (molar)	f
frictional coefficient (molar) for sphere of same volume	f_0
gas constant per mole . .	$\boldsymbol{R}$
gas–liquid chromatography	g.l.c.
gauss	G (*use* SI units: 1 G = 10^{-4} T)
giga (10^9 ×)	G (prefix)
glutathione, oxidized . . .	GSSG (to be defined in a footnote)
glutathione, reduced . . .	GSH (to be defined in a footnote)
α-glycerophosphate . . .	*use sn*-glycerol 3-phosphate when the configuration is to be specified
gram(me)	g
gram(me)-atom	mol *or* g-atom
gram(me)-molecule . . .	mol
gravitational field, unit of (in centrifuging) ($9.81\,m \cdot s^{-2}$)	$\boldsymbol{g}$ (*see* p. 4)
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 ×)	h (prefix) (*see* p. 8)
henry ($m^2 \cdot kg \cdot s^{-2} \cdot A^{-2} = V \cdot A^{-1} \cdot s$)	H
hertz (s^{-1})	Hz
Hill coefficient	h (*not* n)
hour (3600 s)	h
hydrogen ion concentration, minus log of . .	pH, *plural* pH values
hydroquinone	*use* quinol
hydrosulphite, hyposulphite	*not used*, *see* dithionite
illustrations	pp. 6, 24–27

immunoglobulin G etc	IgG etc. (to be defined in a footnote)
inch	in (*use* SI units: $1\,\text{in} = 2.54 \times 10^{-2}\,\text{m}$)
infrared	i.r.
inhibitor constant	K_i (dissociation constant of inhibitor–enzyme complex)
inosine 5′-phosphate	IMP
inosine 5′-pyrophosphate	IDP
inosine 5′-triphosphate	ITP
insoluble	insol.
international unit	i.u.
ionic strength (mol/l)	*I*
ions	p. 15
isoelectric point (the pH at which a molecule has no effective charge)	pI
isoenzyme	*not* isozyme
isotonic	specify composition of solution, e.g. *use* 0.9% NaCl solution
isotopically labelled compounds	p. 15
joule ($\text{m}^2 \cdot \text{kg} \cdot \text{s}^{-2} = \text{N} \cdot \text{m}$)	J
katal (amount of enzyme that can catalyse the transformation of 1 mol of substrate/s under conditions specified)	kat (*see* p. 6)
kelvin	K (not °K)
kephalin	*use* amino phospholipids
keto acid	keto used only generically, *otherwise* oxo
keto sugars	*use* pentulose, hexulose etc., *not* ketopentose, ketohexose etc.
kilo ($10^3 \times$)	k (prefix)
kilogram(me)	kg
Krebs–Ringer solution	reference to be given
level	*use* concentration *or* amount *or* activity where necessary to avoid ambiguity
light petroleum	*not* petroleum ether: boiling range to be stated
litre ($10^{-3}\,\text{m}^3 = \text{dm}^3$)	l; where there is the possibility of confusion between the numeral '1' and the letter 'l', 'litre' should be written in full
logarithm (base 10)	log
logarithm (base e)	ln
lumen (cd·sr)	lm
lux ($\text{m}^{-2} \cdot \text{cd} \cdot \text{sr}$)	lx
maximum	max.
maxwell	Mx (*use* SI units: $1\,\text{Mx} = 10^{-8}\,\text{Wb}$)
median effective dose	ED_{50}
median lethal dose	LD_{50}
mega ($10^6 \times$)	M (prefix)
melting point	m.p.
metabolic quotients	as far as possible the notation Q_x and q_x will not be used; metabolic quotients should, if possible, be given as mol/s or μmol/min for a defined arbitrary quantity of material e.g. mg dry wt., mg of protein, g wet wt. etc.
methanol, methanolic	*not* methyl alcohol
metre	m
Michaelis constant	K_m (*see* p. 6)
micro ($10^{-6} \times$)	μ (prefix)
microgram(me)	μg
microgram(me)-atom	μmol or μg-atom; *not* μatom
micromicro ($10^{-12} \times$)	p (prefix); *not* μμ
*micromolar (concentration)	μM *or* μmol/l
micromole	μmol; *not* μM
micron ($10^{-6}\,\text{m}$)	μm; *not* μ

* 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.

Term	Symbol/usage
milli ($10^{-3}\times$)	m (prefix)
millequivalent	mmol *or* mequiv.
millilitre	ml
millimetre of mercury (conventional) pressure	mmHg (*use* SI units: 1 mmHg ≈ 133.3 Pa)
millimicro ($10^{-9}\times$)	n (prefix); *not* mμ
millimicron (10^{-9}m)	nm; not mμ
*millimolar (concentration)	mM *or* mmol/l
millimole	mmol; *not* mM
minimum	min.
minute (60 s)	min
*molar (concentration)	M *or* mol/l
mole	mol
molecular mass	unlike 'relative molecular mass' this requires units; *see* dalton
molecular weight	'relative molecular mass' preferred (symbol M_r)
nano ($10^{-9}\times$)	n (prefix)
newton ($m\cdot kg\cdot s^{-2} = J\cdot m^{-1}$)	N
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
normal temperature and pressure	*not used*; *use* standard temperature and pressure

Term	Symbol/usage
nuclear magnetic resonance	n.m.r.
nucleoside (unspecified)	N (*not* X)
nucleosides, nucleotides and polynucleotides, symbols for	pp. 13–14
number (in enumerations)	no.
observed	obs.
ohm ($m^2\cdot kg\cdot s^{-3}\cdot A^{-2} = V\cdot A^{-1}$)	Ω
optical rotation	specific optical rotation (with concn. 1 g/ml, light-path 10 cm), e.g. $[\alpha]_D^{20}$, $[\alpha]_{5461}^{25}$ molecular optical rotation ($=[\alpha]_\lambda^t \times$ mol.wt.), e.g. $[M]_D^{20}$, $[M]_{5461}^{20}$. If a different value, e.g. $[\alpha]_\lambda^t \times$ mol.wt./100, is used, this should be stated
optical rotatory dispersion	o.r.d.
optically active isomers	p. 16
orthophosphate (inorganic)	P_i
osmolar	osM *or* osmol/l (the concentration producing an osmotic pressure equal to that of a molar solution of a perfect solute)
page, pages	p., pp.
partial specific volume	$\bar{v}$
partition coefficient (dimensionless)	α or K_D
parts per million	p.p.m.
pascal ($m^{-1}\cdot kg\cdot s^{-2} = N\cdot m^{-2} = J\cdot m^{-3}$)	Pa
per	/
per cent	%
petroleum ether	*not used* (*see* light petroleum)
phosphatide	*use* phospholipid
pico ($10^{-12}\times$)	p (prefix)

* 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.

poise . . . . P (*use* SI units: 1 P = 10^{-1} Pa·s)

potential difference . . . p.d.

pound . . . . lb (*use* SI units: 1 lb ≈ 0.4536 kg)

pound-force per square inch . . . . lbf/in^2 (*use* SI units: 1 lbf/in^2 ≈ 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) PP_i

quinol . . . . *not* hydroquinone

rad (10^{-2} J·kg^{-1}) . . . . rad *or* rd

radian . . . . rad

recrystallized . . . . . recryst.

references . . . . p. 8

refractive index . . . . . *n*; at stated temperature and wavelength represent as, e.g. n_D^{20}

relative band speed (partition chromatography) . *R*, R_F, R_X (*see* p. 5); *plural R* values etc.

relative molecular mass . . M_r; preferred name to 'molecular weight'. Molecular mass (unit: dalton) or molar mass (unit: g·mol^{-1}) may be used when appropriate

reprints . . . . p. 3

respiratory quotient . . . R.Q. (to be defined in a footnote)

revolutions . . . . . . rev.

rev./min . . . . *not* r.p.m.; *use* **g** where possible (*see* p.4)

riboflavin . . . . *alternative permitted* vitamin B_2

ribonuclease . . . . . . RNAase (to be defined in a footnote)

ribonucleic acid . . . . RNA

ribonucleoprotein . . . . RNP (to be defined in a footnote)

ribonucleosides, symbols for . . . . p. 13

röntgen (2.58 × 10^{-4} C·kg^{1}) . . . . . R

second (time) . . . . . s

sedimentation coefficient . *s*; *not* sedimentation constant (*see* p. 4)

sedimentation coefficient corrected to 20°C in water . . . . $s_{20,w}$; s_{20} may be used if it is unambiguous (*see* p. 4)

sedimentation coefficient at zero concentration . . s^0, $s^0_{20,w}$ etc. (*see* p. 4)

siemens (m^{-2}·kg^{-1}·s^3·A^2 = Ω^{-1} = A·V^{-1}) . . . S

sodium dodecyl sulphate . SDS (to be defined in a footnote)

soluble . . . . sol.

solution . . . . soln.

solutions, concentration of pp. 8–9

solvent systems . . . . 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) . . . . sp., spp.

specific gravity . . . . . sp.gr.

square . . . . sq. *or as* e.g. cm^2

standard deviation . . . S.D. (*see* p. 10)

standard error of estimate of mean value . . . . . S.E.M. (*see* p. 10)

standard temperature and pressure . . . . s.t.p.

statistical treatments . . . p. 10

steradian . . . . sr

stokes . . . . St (*use* SI units: 1 St = 10^{-4} m^2·s^{-1})

substituents (variable, in organic compounds) . . R, R′, R″, *or* R^1, R^2, R^3, R^4 (if more than three) (*see* p. 15)

substrate constant . . .	K_s (dissociation constant of substrate–enzyme complex)
sugars, symbols for . . .	p. 14
sulphydryl	*use* thiol *or* SH
sum	Σ
Svedberg unit (10^{-13}s) . .	S (*see* p. 4)
tables (preparation of) . .	p. 10
temperature	(abbreviation) temp.; (symbol) t (empirical), T (absolute)
tera ($10^{12}\times$)	T (prefix)
tesla ($kg \cdot s^{-2} \cdot A^{-1} = V \cdot s \cdot m^{-2} = Wb \cdot m^{-2}$) .	T
thiamin	*alternative permitted* vitamin B_1
thin-layer chromatography	t.l.c.
thymidine 5′-phosphate .	dTMP
thymidine 5′-pyrophosphate	dTDP
thymidine 5′-triphosphate .	dTTP
time (symbol)	t
tocopherol	*alternative permitted* vitamin E
torr	Torr (*use* SI units: 1 Torr ≈ 133.322 Pa)
trichloroacetic acid . . .	TCA *not used*
turnover number	(of an enzyme) *not used*; *see* catalytic-centre activity
ultracentrifuge data . . .	p. 4
ultraviolet	u.v.
uncorrected (e.g. m.p. for emergent stem)	uncorr.
uridine 3′:5′-phosphate . .	cyclic UMP
uridine 5′-phosphate . . .	UMP
uridine 5′-pyrophosphate .	UDP
uridine 5′-triphosphate . .	UTP
variety (e.g. botanical) . .	var.
velocity (symbol)	v
veronal	*used only* for buffer mixtures; *otherwise use* 5,5′-diethylbarbituric acid
viscosity, relative	$\eta_{rel.}$ $\left(\frac{\text{viscosity of solution}}{\text{viscosity of solvent}}\right)$
viscosity, specific	$\eta_{sp.}$ (i.e. $\eta_{rel.} - 1$)
viscosity, reduced	$\eta_{sp.}/c$ (units: ml/g)
viscosity, intrinsic	$[\eta]$, i.e. $\lim_{c \to 0} \eta_{sp.}/c$
volt ($m^2 \cdot kg \cdot s^{-3} \cdot A^{-1} = J \cdot A^{-1} \cdot s^{-1} = J \cdot C^{-1}$) .	V
volume (abbreviation after number)	vol.
v/v	*used only* for two components; by vol. *used* for three or more components
watt ($m^2 \cdot kg \cdot s^{-3} = J \cdot s^{-1}$) .	W
wavelength	λ
wavelength of D line of sodium (other wavelengths in nm)	D (as subscript)
wavenumber (unit) . . .	cm^{-1}
weber ($m^2 \cdot kg \cdot s^{-2} \cdot A^{-1} = V \cdot s$)	Wb
weight	wt.
xanthosine 5′-phosphate .	XMP
xanthosine 5′-pyrophosphate	XDP
xanthosine 5′-triphosphate	XTP

APPENDIX

Notes on the Preparation of Figures

As far as possible artwork supplied by the author will be used for reproduction. 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.

Materials

Diagrams should be in black ink, and may be drawn on white paper, tracing paper or white card. If graph paper is used it is preferable to use one with blue guide lines. Mounting on heavy cardboard is undesirable.

A line thickness obtained with a 0.4 mm Rotring pen (or equivalent) is desirable.

Size

Illustrations for reproduction are reduced to 40% or 50% of the original dimensions, and should be drawn as follows. For reduction to 40%, the width of drawings should not exceed 14 cm (excluding lettering) and 26 cm (excluding lettering) for illustrations intended to be single-column width and double-column width respectively. For reduction to 50%, the width of drawings should not exceed 11 cm (excluding lettering) and 21 cm (excluding lettering) for illustrations intended to be single-column width and double-column width respectively. A margin of at least 3 cm is essential. Any illustrations not conforming to this guide may be photographically adjusted by the printer.

Distinction between curves in a figure

The preferred symbols for experimental points are ○, △, □, ●, ▲, ■. The same symbols must not be used on two curves where the points might be confused. The symbols × and + should be avoided. For scatter diagrams filled-in symbols are preferred. The same symbols should, whernever possible, be used for the same entities throughout a paper. Individual curves may also be distinguished by distinctive line forms (e.g. —, ---- etc.) or by single-letter labels (e.g. *A*, *B* etc.) or by brief explanatory labels (see below).

Lettering

Final lettering on figures will be done by the printer. It is therefore sufficient for authors to insert clear guide lettering in soft pencil. 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.

In a drawing of apparatus the scale must be indicated, but, again, the lettering will be done by the printer.

Technique

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 reproduction if the figures are to be reproduced directly (see above). Scale marks should preferably be within the graph. Axes should not extend appreciably beyond the curves. It is sometimes unnecessary for an axis scale to start at 0; only the part of the scale relevant to the curves should be given.

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.

Specimen figures

Three specimen figures are shown. Fig. 1 illustrates many of the mistakes that necessitate redrawing. Fig. 2 shows a similar figure drawn correctly, and Fig. 3 shows Fig. 2 as it would appear in the *Biochemical Journal.*

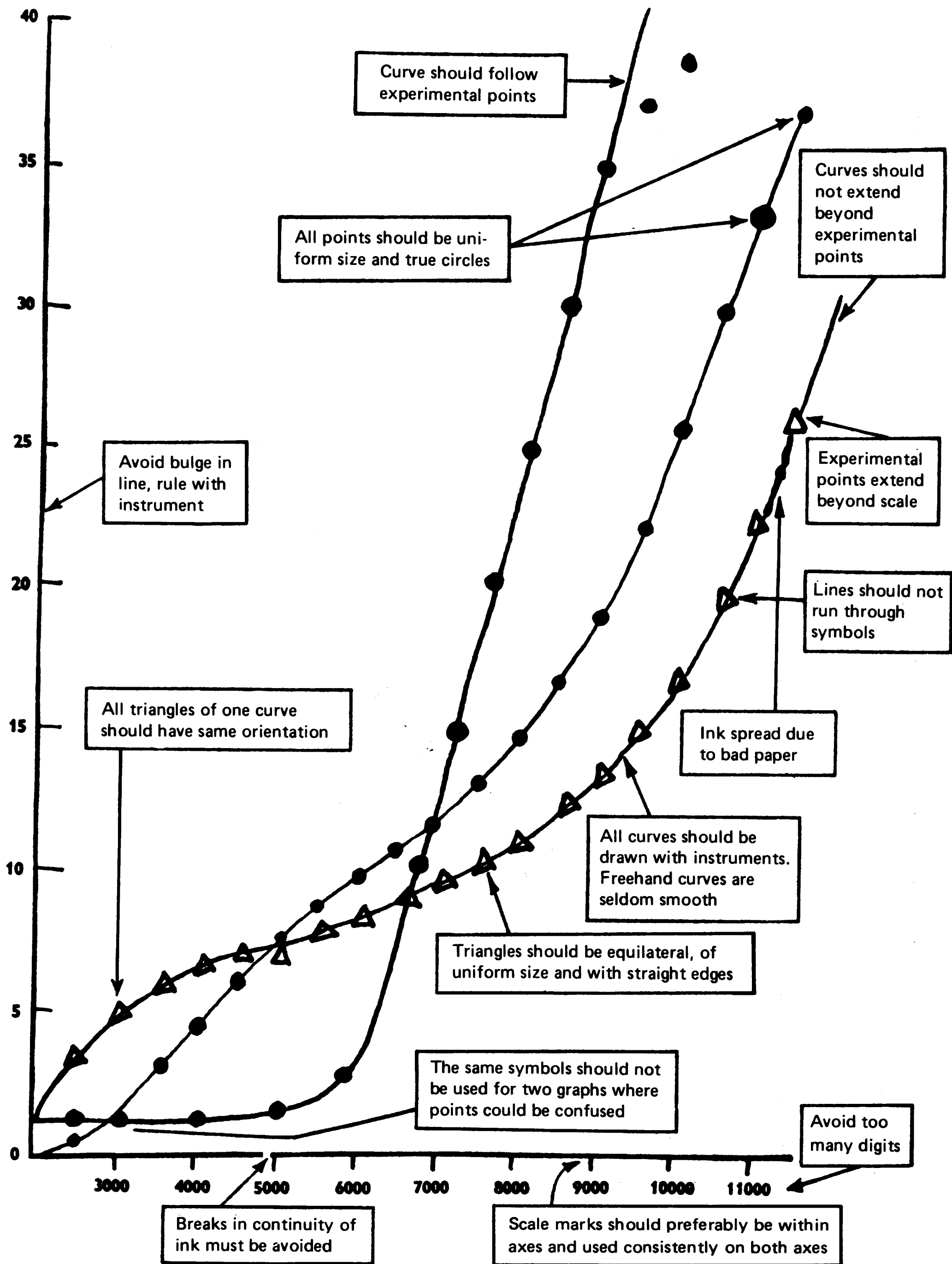
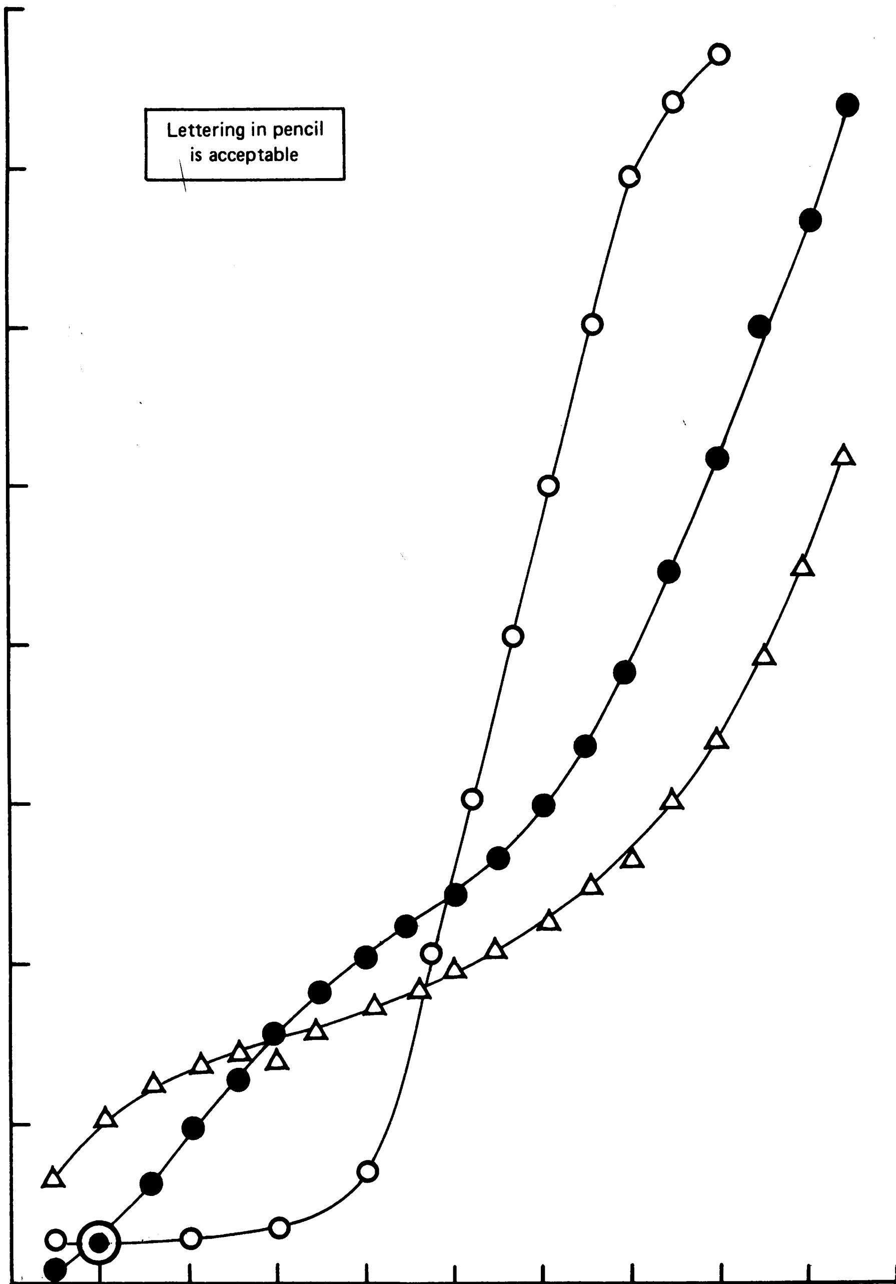
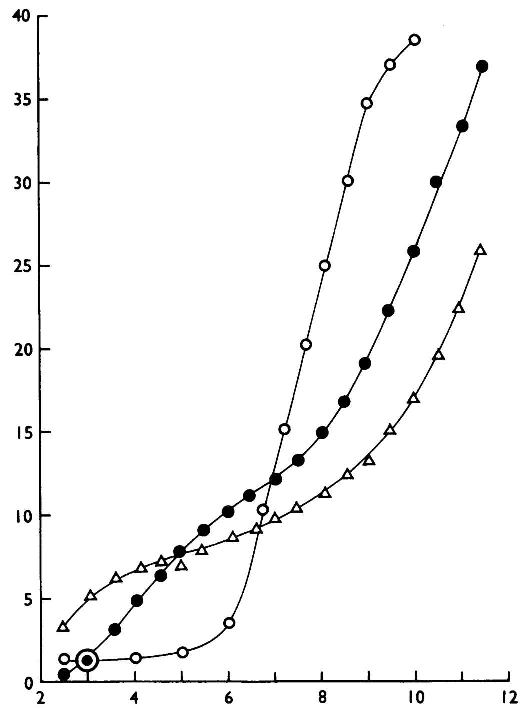


Fig. 1


Lettering in pencil
is acceptable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