The BIOCHEMICAL JOURNAL

January 1975

Volume 145, No. 1

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The Biochemical Society exists to advance the science of biochemistry through meetings and publications. Several meetings a year are held, each at a different place; original papers are presented and special topics are discussed at symposia and colloquia.

Persons interested in biochemistry are eligible for election as Members. Details of further facilities accorded to Members, and forms of application for membership, are available from the Executive Secretary, The Biochemical Society, 7 Warwick Court, London WC1R 5DP [01-242 1076 (4 lines)].

Second-class postage paid at Long Island City, N.Y. 11101, U.S.A.
The Biochemical Journal is published and distributed by the Biochemical Society. It is published twice monthly, alternate issues being devoted to Molecular Aspects and to Cellular Aspects of biochemistry. It is planned that in 1975 eight volumes, each volume being made up of three issues, will be published according to the following schedule:

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* Completes volume, and includes Indexes.

Biochemical Society Transactions. This is now a separate publication (see below). Volume 3 will be published in 1975, in six parts.

Subscription Rates to the Biochemical Journal. For non-members of the Biochemical Society the subscription in 1975 is £105.00. Subject to exchange variation the rate for U.S.A., Canada and Mexico is $265.00 (despatch by air freight to these countries).

Subscribers to the Biochemical Journal can subscribe to Biochemical Society Transactions on a joint subscription, saving £10 ($25.00). The joint subscription is £113.00 ($280.00 to addressees in U.S.A., Canada and Mexico; both publications despatched by air freight).

Terms are cash with order or against proforma invoice. Orders and subscriptions should be sent to the Biochemical Society (Publications), P.O. Box 32, Commerce Way, Colchester CO2 8HP, Essex, or through your normal agent.

Claims regarding issues lost or damaged in transit should be addressed to the Biochemical Society at the address given in the preceding paragraph. Claims cannot be entertained if they are received later than three months after the date of posting.

Back Numbers. Enquiries for volumes 1–19 of the Journal should be addressed to William Dawson & Sons Ltd., Back Issues Department, Cannon House, Park Farm Road, Folkestone, Kent. Quotations for available issues of subsequent volumes and parts of the Journal, and also of Transactions, may be obtained on application to The Biochemical Society (Publications), P.O. Box 32, Commerce Way, Colchester CO2 8HP, Essex.

Microforms. The following versions are available.

(a) Microfilm (35mm): Volumes 1–100.
(b) Microfiche (98-image): Volumes 101–144.

Details and prices are available on request from the Biochemical Society’s Colchester office.

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POLICY OF THE JOURNAL AND INSTRUCTIONS TO AUTHORS

The Policy Statement and the Instructions to Authors are followed by some notes on the Preparation of Papers and Nomenclature that are designed to be helpful to authors. The notes are arranged in alphabetical order and a more detailed index is included in the list of Abbreviations, Symbols, Conventions and Definitions. This document is under continual review by the Editorial Board especially as it may be affected by the decisions of the IUPAC-IUB Commission on Biochemical Nomenclature and other international bodies. The Biochemical Journal uses the recommended SI (Système Internationale) symbols, and encourages, where appropriate, the use of the recommended SI units; although the use of non-SI units is still permitted, it is intended that such usage should be progressively abandoned.

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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.

Two types of paper are accepted by the editors.
1. **Full papers.** These should be written in the style described on pp. 2-3, their length being the minimum required for precision in the description of the experiments and clarity in the interpretation of them. A concise well-written paper tends to be published more rapidly.

2. **Short Communications** (see p. 4). Short Communications should report concise pieces of work that lead to positive conclusions. These papers are generally published about three months after submission.

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 as a full-length paper or Short Communication is scientifically acceptable.

**Functions of 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 knowledge of biochemistry and in which fields of expert knowledge are so distributed that most papers can be dealt with.

Normally a paper is read by at least two people: either by two members of the Editorial Board, or, if an expert opinion in the subject is not available among members of the Board, by a referee and a member of the Board. The main task of editors and referees is to make recommendations on the acceptability of the paper. Requests for revision are normally in the form of one or more editorial reports. After revision by the author, the paper is checked by an editor before being prepared for press in the editorial office. In preparation for the press, particular attention is paid to grammar and the conventions of the Journal with regard to nomenclature, symbols, illustrations, tables and references. If rejection of a paper is recommended, or if there is any serious disagreement between editors, the paper is read by the Chairman or a Deputy.

The Editorial Secretary, who is in charge of the editorial office, administers the business of the Journal, in consultation with members of the Board and with the Chairman of the Board, to whom he is responsible.

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 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.

**Relations between authors and the Editorial Board.** 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 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**

**Full-length papers.** Papers submitted for publication should be sent, together with an extra copy of the synopsis (see below), to the Editorial Secretary, The Biochemical Journal, 7 Warwick Court, London WC1R 5DP. Typescripts should bear the name and address of the person to whom the proof of the paper

*For index to pp. 2-14 see under Abbreviations, Symbols, Conventions and Definitions (pp. 14-20).
conventions of the Biochemical Journal will be returned to the authors for revision. If a paper that has been returned to an author for revision is not resubmitted within one month, it will, on resubmission, be deemed to be a new paper and the date of receipt altered accordingly. A revised paper containing a significant amount of new material will also be redated.

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.

Requests for consent for reproduction of material should be addressed to the Editorial Secretary.

Alternate issues of the Biochemical Journal are devoted to papers on Molecular Aspects and on Cellular Aspects of biochemistry. In addition, titles of papers are arranged under appropriate headings (see current issues of the Biochemical Journal) in the contents list of each issue. Authors are asked to indicate which section and heading are the most appropriate for their paper.

Papers should be headed by a concise but informative full title, by the names of the authors (preferably with one forename in full for each author) and by the name and address of the establishment where the work was performed. (Footnotes indicating present addresses may be included on the title page.) The numbering of parts in a series of papers is not permitted, but titles and subtitles may be used if necessary. Titles of papers are being used increasingly in indexing and in coding for information storage and retrieval; they must therefore be sufficiently descriptive and informative about the contents to be of such practical use. Authors should also give a shortened version of the title, not exceeding 60 letters and spaces, suitable for a running title in the published pages of the work.

The synopsis should contain a brief but informative summary of the contents and conclusions of the paper, and should refer to any new information contained in the paper. It should normally occupy 3–4% of the length of the paper, but should not exceed 250 words. It should contain neither inessential details nor information or claims not contained in the body of the paper. It may be valuable to indicate the treatment of various aspects of the subject by such words as 'brief', 'extensive', 'theoretical', 'experimental' etc. Authors should bear in mind that a synopsis, in addition to its prime role of being a summary of the subject matter, is also read by workers who have only a 'fringe' interest but want as much information as possible about the purpose and significance of the work without reading the whole paper. Synopses are also used by many abstracting journals.

The second copy of the synopsis requested above is required solely to assist in the process of selection of suitable editors or referees, or both.

Details of financial support may appear in the acknowledgements at the end of the paper.

It would help the editors if the author, when submitting a paper, would enclose reprints of relevant preceding papers, especially if they are not published in the Biochemical Journal.

Form of papers submitted for publication. 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. Papers should be in double-spaced typing throughout (including the references and legends of tables and figures) on sheets of uniform size with wide margins. The top copy should be submitted. It cannot be overemphasized that the need for revision of badly prepared typescripts inevitably leads to delays in publication. The main way in which authors can contribute to shortening the time between receipt of a paper and its publication date is to ensure before submission that the requirements and suggestions presented in these Instructions to Authors are met.

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

Papers of biochemical interest are often divided into the following sections: (a) the synopsis, which may be divided into numbered sections; (b) the introduction, containing the reasons for doing the work; (c) Experimental, including materials and methods; (d) Results, which should be given concisely; the use of both tables and figures to present the same results is rarely permitted; (e) Discussion; (f) the acknowledgements; (g) References. Authors are urged to consider carefully whether the material in their individual papers needs to be fully subdivided in the manner of sections (c), (d) and (e). In many papers two of these sections can be combined, thus saving space and gaining conciseness and clarity. In papers dealing predominantly with techniques, the Experimental and Results sections should be amalgamated. Other papers of a more general nature are often simplified by the combination of Results and Discussion, and in chemical papers the Experimental section may be placed at the end. When a separate Discussion is used it should not recapitulate the results but only discuss their significance and relationship to the object of the work and their relation to the work of other people.
Short Communications. Typescripts should be submitted in duplicate, written in English, and conform strictly to the form of the Journal as far as spelling and abbreviations are concerned. Each Short Communication should be provided with a short synopsis (normally not exceeding 50 words). Such communications should not exceed 2400 words in length inclusive of the title, references etc. Authors may include up to two insertions such as tables, figures or schemes; in these cases authors must assess what proportion of a page these insertions will occupy and reduce the number of text words accordingly at the rate of 700 words per full page of the Journal. Authors are advised that the preparation of tables and especially figures is liable to cause a slight increase in publication time. Under no circumstances whatsoever can a complete Short Communication occupy more than four pages of the Journal. Papers should be complete in themselves: (1) the methods used in experimental work must be adequately described or sufficient references given to allow repetition of the work; (2) sufficient indication of the results of experimental work must be included to justify the claims made. Communications should be addressed to the Editorial Secretary, The Biochemical Journal, 7 Warwick Court, London WC1R 5DP. To minimize delay in publication, proofs of accepted Short Communications are not supplied to authors. However, authors are given details of any editing of their 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 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. Contributions that are not being published will be returned to the authors with minimal delay. If a Short Communication has to be returned to the author for amendment, for whatever reason, it will on resubmission be deemed a new paper, and will be redated accordingly. In all cases the editors' and referees' decisions will be final.

PREPARATION OF PAPERS


For nomenclature please refer to the separate section on pp. 9–14. That section is intended to advise directly on some of the more commonly occurring problems in nomenclature. For more specific problems of nomenclature authors are asked to refer to the relevant documents listed on pp. 9–10 and 12–13.

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

Acknowledgements. These must be as short as possible.

Animals. The full binominal Latin names should be included for all experimental animals other than common laboratory animals. The strain, and if possible the source, of laboratory animals should be stated.

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

The time of operation of the rotor at sustained plateau speed (ignoring initial rotor acceleration and deceleration periods) should be stated. The centrifugal field should be stated in multiples of g (as defined on p. 17); the calculation of this field should always be based on the average radius of rotation of the column of liquid in the rotor tubes (or rotor bowl in zonal rotors). For example: 'The rotor was operated for 15 min at 2°C and 10000 g (r<sub>av</sub>, 8 cm)'.

Alternatively, where it is necessary to take into account periods of acceleration and deceleration of the rotor, the rotor speed (ω in rad/s) and time of operation should be integrated and the total integrated field-time stated (as multiples of g) for the average radius of rotation (r<sub>av</sub>) of the column of liquid in the rotor. For example: 'The rotor was operated at 5°C. The integrated field-time was 250000 g min at r<sub>av</sub>, 6.5 cm' [i.e. (r<sub>av</sub>/g)]∫ω<sup>2</sup> dt = 250000 (at r<sub>av</sub>, 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.
**INSTRUCTIONS TO AUTHORS**

**Ultracentrifuge data.** Sedimentation coefficient *(not constant)*, \(s\); sedimentation coefficient corrected to 20°C in water, \(s_{20,w}\); sedimentation coefficient at zero concentration, \(s_0\); \(s_{20,w}\); Svedberg unit \((10^{-13}\text{ s})\), \(S\); partial specific volume, \(\beta\); 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 or drawings of paper or thin-layer chromatograms are not generally published unless they convey information, such as a demonstration of homogeneity, that is not readily established in the text. Densitometric records of chromatograms are always preferable.

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

Solute concentrations in effluents from chromatographic columns should be shown in diagrams with the effluent volume increasing from left to right. Units of solute concentration and effluent volume must be shown clearly on ordinate and abscissa.

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

**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, Yorks. LS23 7BQ, U.K., where it will be stored in its original form and on microfiches (1 microfiche may contain up to 70 pages). However, short items of 10 pages or less will not be available on microfiche, but only as full-size photocopies. 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: 33 cm \(\times\) 24 cm.

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

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

(d) Pages should be clearly numbered to ensure the correct sequence of frames on the microfiche.

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 microfiche or as full-size copies from the library's photocopying services, which work on a pre-paid flat-rate coupon basis.

The present coupon buys one item on microfiche, or 1–10 pages of photocopy from a single item.

The present coupon costs are:

- U.K. £4 for 20 coupons (or 20p. each)
- Europe, £11 for 20 coupons (or 55p. each)
- Elsewhere £13 for 20 coupons (or 65p. each)

The cost includes postage. Outside the U.K. all items are sent by air-mail. The Supplementary Publication number given in the paper in question should be quoted when the item is ordered.

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

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

**Electrophoresis.** Photographs or drawings of electrophoretic separations on paper or cellulose acetate will be published only if they convey information, such as a demonstration of homogeneity, that is not readily established in the text. Photographs of electrophoretic separations in gels such as starch or polyacrylamide may be published if they convey essential information, but, as reproduction may not always be satisfactory, line drawings may be more informative. Densitometric records are usually superior.

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

The symbol pI should be used for isoelectric point.

**Enzymes.** *Enzyme nomenclature.* The recommendations of the latest edition of *Enzyme Nomenclature* [(1973) Elsevier Publishing Co., Amsterdam, London and New York] will be followed as far as possible. This includes the quoting of EC numbers. In general the names of enzymes should not be abbreviated, but approved trivial names may be used (see p. 10).
**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 (1973)]. 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 and its source of supply should be given and the moisture content should be given.

**Kinetic constants.** Velocity constants for the forward and the backward reactions in the nth 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 that 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) [Brit. 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.

**Footnotes.** These should be avoided as far as possible (except in the definition of abbreviations). 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 of the paper and the figure number on the back. Its approximate position should be indicated in the margin of the typescript. Illustrations constitute an expensive item in 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.

**Histograms.** Simple histograms recording only a few values should not be used. The information can be given more concisely in a table.

**Lettering.** Final lettering on figures will be done by the printer; for complex diagrams, which may not be redrawn, authors should insert clear guide lettering in soft pencil. Individual curves should be distinguished, for example, by distinctive symbols (see below), single-letter labels or distinctive line forms. Brief explanatory labels within a figure may be used if the figure is thereby more readily understood and if the labels can be inserted without requiring a larger figure.

**Materials.** Diagrams should be in ink, and may be drawn on paper, graph paper, white card or tracing paper. Mounting on heavy cardboard is undesirable. Photographs of line drawings are acceptable, but if submitted should be on matt paper, not glossy prints.

**Plates.** Plates on art paper are used for the reproduction of half-tone illustrations such as electron micrographs, crucial gel electrophoretograms, X-ray-diffraction patterns etc. Glossy prints are required for these. Where the degree of magnification is to be indicated (e.g. on electron micrographs), this is best done by adding a bar representing a stated length. Photographs of electrophoretograms, radioautograms etc. are reproduced as Plates where this is essential; it is often sufficient for authors to supply tracings of these for reproduction as line blocks on text paper.

**Size.** Illustrations should be approximately twice the dimensions of the finished product as it will appear in the Journal (usually single-column width). A margin of at least 3 cm is essential. The card, cloth or paper on which the drawing is made should not exceed foolscap folio size (33 cm × 21 cm). If drawings larger than 33 cm × 21 cm are unavoidable they must be accompanied by smaller photographic copies for the use of editors. In a drawing of apparatus and in a photomicrograph the scale must be indicated.

**Symbols for experimental points.** The preferred symbols are ○, △, □, ●, ■. The same symbols must not be used on two curves where the points might be confused. The symbols × or + should be avoided. For scatter diagrams filled-in symbols are preferred. The same symbols should, whenever possible, be used for the same entities throughout a paper.

**Technique.** All curves, lines and symbols should be drawn clearly. Curves should not be drawn beyond experimental points. Scale marks must be within the
Instructions to Authors

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.

Shading and hatching should be left to the printer; areas to be shaded or hatched should be indicated lightly in soft pencil.

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 counts 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 disintegrations/second (d.p.s.).

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, Lactobacillaceae), 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 Streg. 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 Demerec, M., Adelberg, E. A., Clark, A. J. & Hartman, P. E. (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.


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 $10^3 k$ means that the value of $k$ is 0.002; an entry '2' under heading $10^{-3} k$ means that the value of $k$ is 2000; (ii) a concentration 0.00015 m may be expressed as 0.15 under heading 'conc. (m)' or as 150 under heading 'conc. (µm)' or as 15 under heading 'conc. (µm)$^{-1}$; (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$^{-1}$). Square brackets may conventionally be used to indicate concentration.

Prefixes for multiples and submultiples of units. These should be as follows:

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

* To be avoided where possible (except for cm).
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 'Krebs & Yuthavong (1971a, b)' or 'Slater & Sawyer, 1969, 1971a, b, c).'

At the end of the paper the 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.


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 (1969) and subsequent Quarterly Supplements (American Chemical Society).

References to books and monographs should include details such as names of editors, edition number, volume number, relevant page numbers, name of publisher and town where published. Examples are:


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


References to 'personal communication' and 'unpublished work' are permitted in the text only, i.e. not in the list of references; editors may require 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.

Solutions. Solutions should be described in terms of molarity (M), not normality (N). Fractional concentrations should be expressed in the decimal system, e.g. 0.25M-HCl (not m/4 HCl). The term % must be defined as w/w, w/v or v/v, e.g. 5% (w/v) means 5g/100ml. 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. '0.09m-sodium acetate–0.01m-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 0.1M. 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. 0.2m-KH2PO4 was adjusted to pH7.4 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 [2-(N-2-hydroxyethylpiperazin-N'-y)ethanesulphonic acid], which should be defined (in parentheses) at the first mention.

Krebs–Ringer solution should be described either by a reference or by giving its composition.
The symbol for ionic strength (mol/l) is I.

**Spectrophotometric data.** Extinction or absorbance \[\log (I_0 / I)\] should be used, *not* optical density. Symbols used are: \(E\), extinction (absorbance); \(E_{1\text{cm}}^{1\text{%}}\), specific extinction coefficient; \(\epsilon\), molar extinction coefficient (the extinction of a molar solution in a 1 cm light-path). The dimensions of \(\epsilon\) should be as recommended by IUPAC, i.e. \(\text{litre} \cdot \text{mol}^{-1} \cdot \text{cm}^{-1}\), *not* \(\text{cm}^2 \cdot \text{mol}^{-1}\).

Ultraviolet, infrared and nuclear-magnetic-resonance spectra will not be published unless they demonstrate important or novel features. When such spectra are essential they should have a wavelength scale, whether or not a wavenumber scale is included.

It is not possible to publish full mass spectra, but the editors may wish to see these. If deemed necessary, the editors may require that these be made available via a data-deposition scheme.

Spectra that are not accepted for publication in the Journal may be deposited with the British Library (Lending Division) (see under “Deposition of data” on p. 5).

**Statistical treatment of results.** In general data from a sufficient number of independent experiments should be reported to permit evaluation of the reproducibility or 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 individual experiments; (ii) the mean value; (iii) the standard deviation (S.D.), the coefficient of variation, or the standard error of the estimate of mean value (S.E.M.), as may be appropriate. *It should be made clear whether the standard deviation or the standard error is used.* A convenient form for inclusion in a table is, for example, \(263 \pm 2.5\) (10), where the number in parentheses represents the number of results.

Where a significant difference is claimed between the means (or other statistics) of two groups of results, the test of significance used should be stated.

In representing statistical quantities by symbols, the convention should be observed of using Greek letters (\(\Sigma\), \(\alpha\), \(\mu\) etc.) for the hypothetical characteristics of the population, and Roman letters (\(S\), \(s\), \(m\) etc.) for actual estimates of their values based on limited samples.

**Symbols for physical units.** The *Biochemical Journal* uses the recommended SI symbols for units [see Pure Appl. Chem. (1970) 21, 1–44; Quantities, Units and Symbols (1971) The Royal Society, London]. Preference should be given to the recommended SI units, e.g. either ‘42 kJ/mol’ or ‘42 kJ/mol (10 kcal/mol)’ is permissible, but not ‘10 kcal/mol’ alone. Details are given below under Abbreviations, Symbols, Conventions and Definitions (pp. 14–20). The symbol for the plural of a unit is the same as that for the singular.

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

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

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

**NOMENCLATURE**

**Biochemical.** As far as possible authors should follow the Recommendations of the IUPAC–IUB 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 6, 11 and 15 below).

2. Trivial names of compounds of importance in biochemistry; nomenclature of isoprenoid side chains; nomenclature and symbols for folic acid and related compounds; nomenclature for corrinoids: Biochem. J. (1967) 102, 15–22 (but see item 10 below).


INSTRUCTIONS TO AUTHORS


Reprints of these Recommendations and information on them can be obtained from Waldo E. Cohn, Director, NRC Office of Biochemical Nomenclature, Oak Ridge National Laboratory, Box Y, Oak Ridge, Tenn. 37830, U.S.A. Comments on the Tentative Rules should be sent to the Commission on Biochemical Nomenclature (Secretary: Waldo E. Cohn).

Abbreviations. The *Biochemical Journal* in general follows the Tentative Rules of the IUPAC–IUB Commission on Biochemical Nomenclature [see *Biochem. J.* (1966) 101, 1–7] and discourages the use of other abbreviations or symbols (except for well-known chemical ones, e.g. Me, Et, Ph, Ac). However, no abbreviations should be used in the title. All abbreviations except those listed below must be defined together in a single footnote at the point of introduction of the first one. 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. Me₂ for DM, H₄ for TH). The name of an entity can often be replaced by short alternatives such as 'the compound', 'the protein', 'the enzyme' etc., or even by 'it'. If an abbreviation is used for a biochemical entity, it is preferable that some indication of the type or class of material should be spelled out. Thus 'turnip yellow-mosaic virus' may be abbreviated to 'TYM virus' but not to 'TYMV', and 'poly(XY)' should not be 'PXY'. This means that in general the names of enzymes should not be abbreviated (for example, 'lactate dehydrogenase' should not be abbreviated to 'LDH', though terms such as 'LDH-1 isoenzyme' would be acceptable); 'ATPase' would, however, be an acceptable abbreviation for 'adenosine triphosphatase', as the suffix 'ase' is sufficient indication that the material is an enzyme and ATP is an 'accepted' abbreviation (see below).

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

ADP, CDP, 5'-Pyrophosphates of adenosine, GDP, IDP, cytidine, guanosine, inosine, uridine, xanthosine, thymidine
UDP, XDP, dTDP

AMP etc.
Adenosine 5'-phosphate etc.

ATP etc.
Adenosine 5'-triphosphate etc.

CM-cellulose
Carboxymethylcellulose

CoA and CoA
cyclic AMP
Coenzyme A and its acyl derivatives
equivalents etc.
Adenosine 3':5'-cyclic phosphate etc.

DEAE-
diethylaminoethylcellulose

DNA
deoxyribonucleic acid

Dnp- or N₂Ph-
2,4-Dinitrophenyl-

Dns- or dansyl-
5-Dimethylaminonaphthalene-1-sulphonyl-

EDTA
Ethylenediaminetetra-acetate

FAD
Flavin-adenine dinucleotide

FMN
Flavin mononucleotide

GSH, GSSG
Glutathione, reduced and oxidized

NAD*
Nicotinamide-adenine dinucleotide

NADP*
Nicotinamide-adenine dinucleotide phosphate

NMN
Nicotinamide mononucleotide

P₄, PP₁
Orthophosphate, pyrophosphate

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RNA, mRNA, Ribonucleic acid and messenger, nRNA, nuclear, ribosomal and transfer rRNA, ribonucleic acid species
tRNA† 
TEAE-cellulose
Tris 2-Amino-2-hydroxymethylpropane-1,3-diol

* Oxidized and reduced forms of the dinucleotides should be indicated as, for example, either NAD*, NADH, or NAD, NADH, 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 tRNAAsp; tRNA bound to amino acid should be given as, for example, alanyl-tRNA or alanyltRNAAsp (note: fMet = formylmethionyl). srRNA should not be used.

Symbols for amino acids [see Biochem. J. (1967) 102, 23–27, and Biochem. J. (1972) 126, 773–780]. These are for use only in representing polymers or sequences and in tables and figures, and need not be defined:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ala</td>
<td>Alanine</td>
</tr>
<tr>
<td>Arg</td>
<td>Arginine</td>
</tr>
<tr>
<td>Asn</td>
<td>Asparagine</td>
</tr>
<tr>
<td>Asp</td>
<td>Aspartic acid</td>
</tr>
<tr>
<td>Asx</td>
<td>Aspartic acid or asparagine (undefined)</td>
</tr>
<tr>
<td>Cys</td>
<td>Cysteine</td>
</tr>
<tr>
<td>Cys or Cys</td>
<td>Cystine (half)</td>
</tr>
<tr>
<td>Gln</td>
<td>Glutamine</td>
</tr>
<tr>
<td>Glu</td>
<td>Glutamic acid</td>
</tr>
<tr>
<td>Glx</td>
<td>Glutamic acid or glutamine (undefined)</td>
</tr>
<tr>
<td>Gly</td>
<td>Glycine</td>
</tr>
<tr>
<td>His</td>
<td>Histidine</td>
</tr>
<tr>
<td>Hyl</td>
<td>Hydroxylysine</td>
</tr>
<tr>
<td>Hyp</td>
<td>Hydroxyproline</td>
</tr>
<tr>
<td>lle</td>
<td>Isoleucine</td>
</tr>
<tr>
<td>Leu</td>
<td>Leucine</td>
</tr>
<tr>
<td>Lys</td>
<td>Lysine</td>
</tr>
<tr>
<td>Met</td>
<td>Methionine</td>
</tr>
<tr>
<td>Orn</td>
<td>Ornithine</td>
</tr>
<tr>
<td>Phe</td>
<td>Phenylalanine</td>
</tr>
<tr>
<td>Pro</td>
<td>Proline</td>
</tr>
<tr>
<td>Ser</td>
<td>Serine</td>
</tr>
<tr>
<td>Thr</td>
<td>Threonine</td>
</tr>
<tr>
<td>Trp</td>
<td>Tryptophan</td>
</tr>
<tr>
<td>Tyr</td>
<td>Tyrosine</td>
</tr>
<tr>
<td>Val</td>
<td>Valine</td>
</tr>
</tbody>
</table>

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):

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

General symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Unspecified purine nucleoside</td>
</tr>
<tr>
<td>Y</td>
<td>Unspecified pyrimidine nucleoside</td>
</tr>
<tr>
<td>N</td>
<td>Unspecified nucleoside (not X)</td>
</tr>
</tbody>
</table>

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

The letter A (for terminal 2’-phosphate only) or a hyphen (for phosphodiester group only) to the right of a nucleoside symbol indicates a 2’-phosphate; to the left it indicates a 3’-phosphate, e.g.:

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(C₃₄,U)Gp

indicates a heptanucleotide composed of three nucleotides of known sequence but with a trinucleo-
tide 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(A₃₈C₃₈) random co-polymer of A and C in 3:2 proportions
poly(dA-T) or poly(dA-dT) alternating co-polymer of dA and dT

The prefix co-poly or oligo may replace poly, if desired. An alternative form is, e.g., Aₙ for poly(A), where the subscript n may be replaced by numerals indicating actual size. Similarly, d(A-T)ₙ etc. may be used for poly(dA-dT) etc. It should be noted that 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) triple-stranded complex of poly(G) and poly(C) in the proportions 1:2
poly(dA-dC) • poly- associated poly(dA-dC) and poly(dG-dT)
(dA-dC)ₙ • (dG-dT)ₙ
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 'adenine-thymine base pair' or 'A • T base pair'
in the text.
† Also 'A + T content' (and 'A-T sequence'), not 'AT content' (nor 'AT sequence'), in the text.

Symbols for sugars [see Biochem. J. (1966) 101, 1–7]. These are for use only in representing polymers or sequences and in tables and figures, and need not be defined:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ara</td>
<td>Arabinose</td>
</tr>
<tr>
<td>dRib*</td>
<td>2-Deoxyribose</td>
</tr>
<tr>
<td>Fru</td>
<td>Fructose</td>
</tr>
<tr>
<td>Fuc</td>
<td>Fucose</td>
</tr>
<tr>
<td>Gal</td>
<td>Galactose</td>
</tr>
<tr>
<td>Glc†</td>
<td>Glucose</td>
</tr>
<tr>
<td>Man</td>
<td>Mannose</td>
</tr>
<tr>
<td>Rib</td>
<td>Ribose</td>
</tr>
<tr>
<td>Xyl</td>
<td>Xylose</td>
</tr>
</tbody>
</table>

* 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. Ribf for ribofuranose.

Symbols thus formed are joined by short dashes or arrows to indicate the links between units. The position and nature of the links are shown by numerals and the anomic symbols α and β, e.g.:

Maltose Glcpa1-4Glc or Glcpa1→4Glc
Lactose Galβ1-4Glc or Galβ1→4Glc

The arrow points away from the hemiacetal link. If the dash is used, it is assumed that the hemiacetal link is to the left of it.

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

A for uronic acids (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: AcNeu suffices for N-acetylmuraminate [see Biochem. J. (1972) 126, 775].

This system differs in some respects from that described previously [Biochem. J. (1966) 101, 1–7] and from that recommended by the Chemical Society. Authors may use the Chemical Society system if they wish, but should state this explicitly, to avoid possible ambiguity.

Definitive names for oligosaccharides are often too cumbersome for repeated mention in the text of a paper, and shortened names that, within the conventions of the system employed, are unambiguous may be used [see, e.g., Biochem. J. (1956) 63, 200–206; 64, 340–351; 64, 351–361]. At its first mention the definitive name should be given in parentheses after the shortened name.

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


2. Nomenclature of organic chemistry:

   Sections A (hydrocarbons), B (fundamental heterocyclic systems) and C (characteristic groups containing carbon, hydrogen, oxygen, nitrogen, halogen, sulphur, selenium and/or tellurium) (combined and revised edition) [(1971) Butterworths, London].

The Handbook for Chemical Society Authors ([1961] The Chemical Society, London) contains the first editions of the IUPAC Rules for the nomenclature of inorganic chemistry and for the nomenclature of organic chemistry (sections A and B) with useful explanatory footnotes, together with detailed proposals on points of nomenclature not specifically covered in these Rules. This book is now out of print, but authors may find it useful to consult if they have access to a copy.

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.), [α]D +17±2° (c 1.6 in water), light-absorption max. in ethanol 226 and 265nm (ε 2200 and 2500 respectively) (Found: C, 40.8; H, 6.9; N, 11.5; OMe, 26.0; C₁₂H₁₆N₂O₆ 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 C₁₀H₁₄O₂: 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 C₁₈H₂₁N₂O₂, 2H₂O: C, 49.7; H, 3.9; N, 4.2; H₂O, 5.3%). If water of crystallization is claimed, evidence should be given, e.g. as loss at 100°C as above, or the reason why it cannot be given should be explained.

Distillation of the product gave a middle fraction (0.3g), b.p. 120°C/1.9kPa (15mmHg), nₒ¹⁄₆ 1.4767.

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

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

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

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

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

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

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 R¹, R², R³, R⁴ if more than three) should be used to denote variable substituents in formulae.

C₂₀ acid is used to denote an acid containing 20 carbon atoms and C-3 or C₁₃ to denote the carbon atom numbered 3. C₁₈H₉₀, C₁₈H₁₁ etc. are used similarly to denote the number of double bonds in an unsaturated fatty acid.

Ions. These should be represented thus: Na⁺, Zn²⁺, Cl⁻, PO₄⁻².

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

The isotopic prefix precedes that part of the name to which it refers, as in sodium [¹⁴C]formate, iodo-[¹⁴C]acetic acid, 1-aminio[¹⁴C]methylenecyclopentanol (H₂N-¹⁴C(CH₃-C₅H₅-OH), α-naphthyl[¹⁴C]oic acid (Ci₀H₁₄-¹⁴C₂O₂H), 2-acetamido-7-[¹³¹I]iodofluorene, fructose 1,6-[¹³¹I]diiodophosphate, p-[¹⁴C]glucose, 2H-[²-¹H]pyran, S-[⁸⁻¹⁴C]adenosyl[¹⁴S]methionine. Terms such as [¹³¹I]-labelled albumin' should not be contracted to '[¹³¹I]albumin' (since native albumin does not contain iodine), and [¹⁴C]-labelled amino acids' should similarly not be written as '[¹⁴C]amino acids' (since there is no carbon in the amino group).

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

When not sufficiently distinguished by the foregoing means, the positions of isotopic labelling are indicated by Arabic numerals, Greek letters, or prefixes (as appropriate), placed within the square brackets and before the symbol of the element concerned, to which they are attached by a hyphen; examples are [¹⁻²H]ethanol (CH₃-C²H₂-OH), [¹⁻¹⁴C]aniline, L-[²⁻¹⁴C]leucine (or L-[α-¹⁴C]-leucine), [carboxy-¹⁴C]leucine, [Me-¹⁴C]isoleucine, [2⁻³⁻¹⁴C]maleic anhydride, [6⁻⁷⁻¹⁴C]xanthopterin,

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

For simple molecules, however, it is often sufficient to indicate the labelling by writing the chemical formulae, e.g. 14CO2, H218O, 2H2O (not D2O), H235SO4, with the prefix superscripts attached to the proper atomic symbols in the formulae. The square brackets are not to be used in these circumstances, nor when the isotopic symbol is attached to a word that is not a chemical name, abbreviation or symbol (e.g. '35-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-o-cysteine, 2-p-isopropylphenylheptane, ethyl methyl ketone (butan-2-one).

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**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. 9–10 and 12–13).

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>pp. 10–11</th>
<th>Absorbance</th>
<th>pp. 10–11</th>
<th>Acceleration due to gravity</th>
<th>p. 9</th>
<th>Adenosine 3'-5'-cyclic phosphate</th>
<th>cyclic AMP</th>
<th>Adenosine 5'-phosphate</th>
<th>AMP</th>
<th>Adenosine 5'-pyrophosphate</th>
<th>ADP</th>
<th>Adenosine triphosphatase</th>
<th>ATPase (to be defined in a footnote)</th>
<th>Adenosine 5'-triphosphate</th>
<th>ATP; the three phosphorus atoms are distinguished as α, β and γ, thus: adenosine-Pβ-O-Pα-O-Pγ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternating current</td>
<td>a.c.</td>
<td>Amino acids, symbols for</td>
<td>p. 11</td>
<td>2-amino-2-hydroxy-methylpropane-1,3-diol</td>
<td>Tris</td>
<td>Ampere</td>
<td>A</td>
<td>Ängström</td>
<td>Å (use SI units: 1 Å = 0.1 nm)</td>
<td>Approximately</td>
<td>approx. (or use about, not c. or ca.)</td>
<td>Aquous</td>
<td>Aqu.</td>
<td>Ascorbic acid</td>
<td>alternative permitted vitamin C</td>
</tr>
</tbody>
</table>
INSTRUCTIONS TO AUTHORS

boiling point . . . . . b.p.
buffers . . . . . pp. 8–9
calciferol . . . . . use ergocalciferol, alternative permitted vitamin D₃

*calorie, I.T. . . . . \( \text{cal}_\text{I} \) (use SI units: \( 1 \text{cal}_\text{I} = 4.1868 \text{J} \))
*calorie, thermochemical . \( \text{cal}_\text{Ia} \) (use SI units: \( 1 \text{cal}_\text{Ia} = 4.184 \text{J} \))
candela . . . . . cd
capric acid . . . . . use decanoic acid
caproic acid . . . . . use hexanoic acid
caproyl . . . . . use hexanoyl
capryl, caprinoyl . . . . . use decanoyl
caprylic acid . . . . . use octanoic acid
capryl, capryloyl . . . . . use octanoyl
carbozbenzoxyl . . . . . use benzyloxybenzyl
carboxymethylcellulose . . . . . CM-cellulose
catalytic-centre activity . number of molecules of substrate transformed/ min per catalytic centre
centi (10⁻² x) . . . . . c (prefix) (see p. 7)
centimetre . . . . . cm
centimetre gram(me) second . . . . . c.g.s.
centrifuging . . . . . pp. 4–5
cholecaldiferol . . . . . alternative permitted vitamin D₃
chromatography . . . . . p. 5
cocarboxylase . . . . . use thiamin pyrophosphate
coefficient of variation . standard deviation/ mean value (see p. 9)
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 . . . . . \( k \)
corrected (e.g. m.p. for emergent stem) . . . . . corr.
coulomb (s·A) . . . . . C
counts/min, counts/s . . . . . c.p.m., c.p.s. (see p. 7)
crystalline, crystallized . . . . . cryst.
cubic . . . . . cu. or as e.g. mm³
curie (3.7 \( \times 10^{10} \text{s}^{-1} \)) . . . . . Ci
cycles per second . . . . . Hz
cytidine 5'-phosphate . . . . . CMP
cytidine 5'-pyrophosphate . . . . . CDP
cytidine 5'-triphosphate . . . . . CTP
dalton (\( 1 \text{Da} \) of the mass of one atom of carbon isotope \( _{12}\text{C} \), i.e. \( 1.663 \times 10^{-24} \text{g} \)) . . . . . not to be used for molecular weights
data (N.B.: plural) . . . . . use only in the sense of 'information given'
data, deposition of . . . . . p. 5
deci (10⁻¹ x) . . . . . d (prefix) (see p. 7)
decomposition (m.p.) . . . . . decomp.
degrees Celsius (\( ^\circ \text{C} \)) . . . . . \( ^\circ \text{C} \)
degrees Kelvin . . . . . \( ^\circ \text{K} \) (preferred to SI recommended symbol K for kelvin)
deka (10×) . . . . . da (prefix) (see p. 7)
deoxy (prefix) . . . . . not deoxy; symbol d
deoxyribonuclease . . . . . DNAase (to be defined in a footnote)
deoxyribonucleic acid . . . . . DNA
deoxyribonucleosides, symbols for . . . . . p. 11
dialysable . . . . . not permitted; use diffusible (see p. 5)

* The symbol 'cal' may be used where the degree of accuracy does not justify distinction between \( \text{cal}_\text{I} \) and \( \text{cal}_\text{Ia} \).

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<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>dialysate</td>
<td><em>not used; for diffusible material use diffusate (see p. 5)</em></td>
</tr>
<tr>
<td>diethylaminoethylcellulose</td>
<td>DEAE-cellulose</td>
</tr>
<tr>
<td>diffusion coefficient</td>
<td>$D, D^0, D_{10, w}$ etc. (as for sedimentation coefficient) (see p. 5)</td>
</tr>
<tr>
<td>dilute</td>
<td>dil.</td>
</tr>
<tr>
<td>5-dimethylaminonaphthalene-1-sulphonyl-</td>
<td>Dns- or dansyl-</td>
</tr>
<tr>
<td>2,4-dinitrophenyl-</td>
<td>Dnp- or N2ph-</td>
</tr>
<tr>
<td>direct current</td>
<td>d.c.</td>
</tr>
<tr>
<td>disintegrations/min, disintegrations/s</td>
<td>d.p.m., d.p.s.</td>
</tr>
<tr>
<td>dissociation constant, minus log of</td>
<td>pK, plural pK values</td>
</tr>
<tr>
<td>disulphide group</td>
<td>alternative permitted S–S</td>
</tr>
<tr>
<td>dithionite (sodium)</td>
<td>Na$_2$S$_2$O$_4$, <em>not</em> hydro-sulphite, hyposulphite</td>
</tr>
<tr>
<td>dry ice</td>
<td><em>use</em> solid CO$_2$</td>
</tr>
<tr>
<td>dyne</td>
<td>dyn (use SI units: 1 dyn = 10$^{-5}$N)</td>
</tr>
<tr>
<td>electrode potential, standard</td>
<td>$E_0$</td>
</tr>
<tr>
<td>electrode potential, standard at given pH</td>
<td>$E'_0$</td>
</tr>
<tr>
<td>electromotive force</td>
<td>e.m.f.</td>
</tr>
<tr>
<td>electronvolt ($\approx 1.6022 \times 10^{-19}$ J)</td>
<td>eV</td>
</tr>
<tr>
<td>electrophoretic mobility ($m^2 \cdot s^{-1} \cdot V^{-1}$)</td>
<td>$m$ (see p. 5)</td>
</tr>
<tr>
<td>elementary analyses</td>
<td>p. 13</td>
</tr>
<tr>
<td>enthalpy (change)</td>
<td>$\Delta H$ (kJ mol$^{-1}$)</td>
</tr>
<tr>
<td>entropy (change)</td>
<td>$\Delta S$ (kJ mol$^{-1}$ K$^{-1}$) (not e.u.)</td>
</tr>
<tr>
<td>enzyme units</td>
<td>p. 6</td>
</tr>
<tr>
<td>equation</td>
<td>eqn.</td>
</tr>
<tr>
<td>equivalent (weight)</td>
<td>equiv.</td>
</tr>
<tr>
<td>erg</td>
<td>erg (use SI units: 1 erg = 10$^{-7}$ J)</td>
</tr>
<tr>
<td>ethanol, ethanolic</td>
<td><em>not</em> ethyl alcohol, <em>not</em> alcoholic</td>
</tr>
<tr>
<td>ethylenediaminetetraacetate</td>
<td>EDTA</td>
</tr>
<tr>
<td>Experiment (with reference numeral)</td>
<td>Expt.; plural Expts.</td>
</tr>
<tr>
<td>extinction</td>
<td>log ($I_0/I$) (p. 9)</td>
</tr>
<tr>
<td>farad ($m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$)</td>
<td>$F$</td>
</tr>
<tr>
<td>Faraday (quantity of electricity associated with 1g-equiv. of chemical change)</td>
<td>$F$</td>
</tr>
<tr>
<td>fatty acids</td>
<td>p. 13</td>
</tr>
<tr>
<td>femto ($10^{-15} \times$)</td>
<td>f (prefix)</td>
</tr>
<tr>
<td>Figure (with reference numeral)</td>
<td>Fig.; plural Figs.</td>
</tr>
<tr>
<td>figures, preparation of</td>
<td>pp. 6–7</td>
</tr>
<tr>
<td>flavin–adenine dinucleotide</td>
<td>FAD</td>
</tr>
<tr>
<td>flavin mononucleotide</td>
<td>FMN</td>
</tr>
<tr>
<td>foot</td>
<td>ft (use SI units: 1 ft = 0.3048 m)</td>
</tr>
<tr>
<td>foot-candle</td>
<td>ft-candle (use SI units: 1 ft-candle = 10.7639 lux)</td>
</tr>
<tr>
<td>formulae</td>
<td>p. 13</td>
</tr>
<tr>
<td>free energy (Gibbs) (change)</td>
<td>$\Delta G$ (kJ mol$^{-1}$)</td>
</tr>
<tr>
<td>frictional coefficient (molar)</td>
<td>$f$</td>
</tr>
<tr>
<td>frictional coefficient (molar) for sphere of same volume</td>
<td>$f_0$</td>
</tr>
<tr>
<td>gas constant per mole</td>
<td>$R$</td>
</tr>
<tr>
<td>gas–liquid chromatography</td>
<td>g.l.c.</td>
</tr>
<tr>
<td>gauss</td>
<td>G (use SI units: 1 G = 10$^{-4}$ T)</td>
</tr>
<tr>
<td>giga ($10^9 \times$)</td>
<td>G (prefix)</td>
</tr>
<tr>
<td>glutathione, oxidized</td>
<td>GSSG</td>
</tr>
<tr>
<td>glutathione, reduced</td>
<td>GSH</td>
</tr>
<tr>
<td>$\alpha$-glycerophosphate</td>
<td><em>use</em> sn-glycerol 3-phosphate when the configuration is to be specified</td>
</tr>
<tr>
<td>gram(me)</td>
<td>g</td>
</tr>
</tbody>
</table>
gram(me)-atom ... mol or g-atom
gram(me)-equivalent ... mol or g-equiv.
gram(me)-molecule ... mol
gravitational field, unit of (in centrifuging) (9.81 m·s⁻²) ... g (see p. 4)
guanosine 3'-5'-cyclic phosphate ... cyclic GMP
guanosine 5'-phosphate ... GMP
guanosine 5'-pyrophosphate ... GDP
guanosine 5'-triphosphate ... GTP
haem, protohaem ... prosthetic group of haemoglobin
haematin, protohaematin ... oxidized haem
haemochromogen ... haem + base or haem + denatured protein
hecto (10²x) ... h (prefix) (see p. 7)
henry (m²·kg·s⁻²·A⁻² = V·A⁻¹·s) ... H
hertz (s⁻¹) ... Hz
Hill coefficient ... h (not n)
hour (3600s) ... h
hydrogen ion concentration, minus log of ... pH, plural pH values
hydroquinone ... use quinol
hydrosulphite, hyposulphite ... not used, see dithionite
illustrations ... pp. 6–7
inch ... in (use SI units; 1 in = 2.54 × 10⁻² m)
infrared ... i.r.
inhibitor constant ... Kᵢ (dissociation constant of inhibitor–enzyme complex)
inosine 5'-phosphate ... IMP
inosine 5'-pyrophosphate ... IDP
inosine 5'-triphosphate ... ITP
insoluble ... insol.
national unit ... i.u.
ionic strength (mol/l) ... I
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 ... pp. 13–14
joule (m²·kg·s⁻² = N·m) ... J
katal (amount of enzyme that can catalyse the transformation of 1 mol of substrate/s under conditions specified) ... kat (see p. 6)
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 m³ = dm³) ... 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 (m⁻²·cd·sr) ... lx
maximum ... max.
INSTRUCTIONS TO AUTHORS

maxwell . . . . . Mx (use SI units: 1 Mx = 10⁻⁸ Wb)

median effective dose . . . ED₅₀
median lethal dose . . . LD₅₀
mega (10⁶ ×) . . . . M (prefix)
melting point . . . . . m.p.
metabolic quotients . . . as far as possible the notation Qₓ and qₓ 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 . . . Kₘ (see p. 6)
micro (10⁻⁶ ×) . . . . µ (prefix)
microgram(me). . . . . µg
microgram(me)-atom . . . µmol or µg-atom; not µatom
micromicro (10⁻¹² ×) . . . p (prefix); not µµ
micromole . . . . . µmol; not µµ
micron (10⁻⁶ m) . . . . µm; not µ
milli (10⁻³ ×) . . . . m (prefix)
milliequivalent . . . . mmol or mequiv.
millilitre. . . . . . ml
millimetre of mercury (conventional) pressure . . . mmHg (use SI units: 1 mmHg ≈ 133.3 Pa)
millimicro (10⁻⁹ ×) . . . n (prefix); not µµ
millimicron (10⁻⁹ m) . . . nm; not µµ
*millimolar (concentration) . . . . . mm or mmol/l
millimole . . . . . mmol; not µµ
minimum . . . . . min.
minute (60 s) . . . . min
*molar (concentration) . . . m or mol/l
mole . . . . . mol

molecular weight . . . mol.wt. (molecular weights are ratios and it is incorrect to add the word 'daltons')
nano (10⁻⁹ ×) . . . . n (prefix)
newton (m·kg·s⁻² = J·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 mono-nucleotide . . . . NMN
normal temperature and pressure . . . not used; use standard temperature and pressure
nuclear magnetic resonance . . . . n.m.r.
nucleoside (unspecified) . . . N (not X)
nucleosides, nucleotides and polynucleotides, symbols for . . . . pp. 11–12
number (in enumerations) . . . . . no.
observed . . . . . obs.
ohm (m²·kg·s⁻³·A⁻² = V·A⁻¹) . . . . . Ω
optical rotation . . . . . . . . . specific optical rotation (with concn. 1 g/ml, light-path 10 cm), e.g. [α]D²⁵, [α]D₂⁵. Molecular optical rotation (= [α]D x mol.wt.), e.g. [M]D²⁵, [M]D₂⁵. If a different value, e.g. [α]D x mol.wt./100, is used, this should be stated

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

1975
<table>
<thead>
<tr>
<th>Term</th>
<th>Symbol/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>optically active isomers</td>
<td>p. 14</td>
</tr>
<tr>
<td>orthophosphate (inorganic)</td>
<td>$P_i$</td>
</tr>
<tr>
<td>osmolar</td>
<td>osm or osmol/l (the concentration producing an osmotic pressure equal to that of a molar solution of a perfect solute)</td>
</tr>
<tr>
<td>partial specific volume</td>
<td>$\bar{v}$</td>
</tr>
<tr>
<td>partition coefficient (dimensionless)</td>
<td>$\alpha$ or $K_D$</td>
</tr>
<tr>
<td>parts per million</td>
<td>p.p.m.</td>
</tr>
<tr>
<td>pascal (m$^{-1}$·kg·s$^{-2}$ = N·m$^{-2}$ = J·m$^{-3}$)</td>
<td>Pa</td>
</tr>
<tr>
<td>per</td>
<td>/</td>
</tr>
<tr>
<td>per cent</td>
<td>%</td>
</tr>
<tr>
<td>petroleum ether</td>
<td><em>not used</em> (see light petroleum)</td>
</tr>
<tr>
<td>phosphatid</td>
<td>use phospholipid</td>
</tr>
<tr>
<td>pico ($10^{-12} \times$)</td>
<td>$p$ (prefix)</td>
</tr>
<tr>
<td>poise</td>
<td>$P$ (use SI units: $1 \text{Pa} = 10^{-1} \text{Pa} \cdot \text{s}$)</td>
</tr>
<tr>
<td>potential difference</td>
<td>p.d.</td>
</tr>
<tr>
<td>pound</td>
<td>lb (use SI units: $11 \text{lb} \approx 0.4536\text{kg}$)</td>
</tr>
<tr>
<td>precipitate</td>
<td>ppt.</td>
</tr>
<tr>
<td>preparation</td>
<td>prep.</td>
</tr>
<tr>
<td>probability of an event's being due to chance alone</td>
<td>$P$</td>
</tr>
<tr>
<td>pyridoxine, pyridonal</td>
<td>alternative permitted vitamin B-6 [see Biochem. J. (1974) 137, 417-421]</td>
</tr>
<tr>
<td>refractive index</td>
<td>$n$; at stated temperature and wavelength represent as, e.g., $n_0^2$</td>
</tr>
<tr>
<td>relative band speed (partition chromatography)</td>
<td>$R, R_p, R_x$ (see p. 5); plural $R$ values etc.</td>
</tr>
<tr>
<td>reprints</td>
<td>p. 2</td>
</tr>
<tr>
<td>respiratory quotient</td>
<td>R.Q. (to be defined in a footnote)</td>
</tr>
<tr>
<td>revolutions</td>
<td>rev.</td>
</tr>
<tr>
<td>rev./min</td>
<td><em>not r.p.m.; use g</em> where possible (see p. 4)</td>
</tr>
<tr>
<td>riboflavin</td>
<td>alternative permitted vitamin B$_2$</td>
</tr>
<tr>
<td>ribonuclease</td>
<td>RNAaese (to be defined in a footnote)</td>
</tr>
<tr>
<td>ribonucleic acid</td>
<td>RNA</td>
</tr>
<tr>
<td>ribonucleosides, symbols for</td>
<td>p. 11</td>
</tr>
<tr>
<td>röntgen</td>
<td>$(2.58 \times 10^{-4} \text{C} \cdot \text{kg}^{-1})$</td>
</tr>
<tr>
<td>second (time)</td>
<td>s</td>
</tr>
<tr>
<td>sedimentation coefficient</td>
<td>s; <em>not</em> sedimentation constant (see p. 5)</td>
</tr>
<tr>
<td>sedimentation coefficient corrected to 20°C in water</td>
<td>$s_{20,w}$; $s_{20}$ may be used if it is unambiguous (see p. 5)</td>
</tr>
<tr>
<td>sedimentation coefficient at zero concentration</td>
<td>$s^0$, $s_{20,0}$ etc. (see p. 5)</td>
</tr>
<tr>
<td>siemens (m$^{-2}$·kg$^{-1}$·s$^{-3}$·A$^2$ = $\Omega^{-1}$ = A·V$^{-1}$)</td>
<td>S</td>
</tr>
<tr>
<td>soluble</td>
<td>sol.</td>
</tr>
<tr>
<td>solution</td>
<td>soln.</td>
</tr>
<tr>
<td>solutions, concentration of</td>
<td>p. 8</td>
</tr>
<tr>
<td>solvent systems</td>
<td>e.g. butan-1-ol–acetic acid–water (4:1:1, by vol.), butan-1-ol–acetic acid (4:1, v/v)</td>
</tr>
<tr>
<td>species (singular and plural)</td>
<td>sp., spp.</td>
</tr>
<tr>
<td>specific gravity</td>
<td>sp.gr.</td>
</tr>
<tr>
<td>square</td>
<td>sq. or as e.g. cm$^2$</td>
</tr>
<tr>
<td>standard deviation</td>
<td>S.D.</td>
</tr>
<tr>
<td>standard error of estimate of mean value</td>
<td>S.E.M. (see p. 9)</td>
</tr>
</tbody>
</table>

Vol. 145
standard temperature and pressure s.t.p.
statistical treatments p. 9
steradian sr
stokes St (use SI units: 1 St = 10^-4 m^2 s^-1)
substituents (variable, in organic compounds) R, R', R*, or R1, R2, R3, R4 (if more than three) (see p. 13)
substrate constant Kd (dissociation constant of substrate–enzyme complex)
sugars, symbols for p. 12
sulphydryl use thiol or SH
sum Σ or S (see p. 9)
Svedberg unit (10^-13 s). S (see p. 5)
tables (preparation of). p. 9
temperature (abbreviation) temp.; (symbol) t (empirical), T (absolute)
tera (10^12 x). T (prefix)
tesla (kg s^-2 A^-1 = V s m^-2 = Wb m^-2) T
thiamin alternative permitted vitamin B1
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)
thtrichloroacetic acid TCA not used
triethylaminoethylcellulose TEAE-cellulose
turnover number (of an enzyme) not used; see catalytic-centre activity

ultracentrifuge data p. 5
ultraviolet u.v.
uncorrected (e.g. m.p. for emergent stem) uncorr.
uridine 3':5' cyclic 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 ηvisc. (viscosity of solution) (viscosity of solvent)
viscosity, specific ηsp. (i.e. ηvisc. − 1)
viscosity, reduced ηsp./c (units: ml/g)
viscosity, intrinsic [η], i.e. limε→∞ ηsp./c
volt (m^2 kg s^-3 A^-1 = J s^-1 = J C^-1) V
volume (abbrev. after number) vol.
v/v used only for two components; by vol. used for three or more components
watt (m^2 kg s^-3 = J s^-1) W
wavelength λ
wavelength of D line of sodium (other wavelengths in Å) D (as subscript)
wavenumber (unit). cm^-1
weber (m^2 kg s^-2 A^-1 = V s) Wb
weight wt.
xanthosine 5'-phosphate XMP
xanthosine 5'-pyrophosphate XDP
xanthosine 5'-triphosphate XTP
International Union of Immunological Sciences

Recommendations for the Nomenclature of Human Immunoglobulins

The following is a document prepared by a Subcommittee\(^1\) for Human Immunoglobulins of the IUISC Nomenclature Committee, and reproduced by permission of its chairman.\(^2\)

Preamble

The final draft was developed after receiving additional suggestions from colleagues who had assisted in reaching agreement on the earlier nomenclatures published in 1964 and 1969. The report of the Subcommittee has been reviewed and approved by the Nomenclature Committee of the IUISC.

Terminology for Immunoglobulin Molecules

Following a proposal made in 1964,\(^1\) two symbols (\(\text{Ig}\) and \(\gamma\)) have been used interchangeably to designate human or animal immunoglobulins. Although it was pointed out that \(\text{Ig}\) is a logical symbol for immunoglobulins, the symbol \(\gamma\) was retained as an acceptable substitute, mainly in view of the tradition that had long associated it with the immunoglobulins.

In recent years there has been a trend among editors and authors to give increasing preference to the symbol \(\text{Ig}\). A major reason for dissatisfaction with the existing dual terminology, \(\text{Ig}\) and \(\gamma\), is that the symbol \(\gamma\) is also employed to designate the heavy polypeptide chains of a particular class of immunoglobulins.

It is therefore proposed to discontinue the use of the symbol \(\gamma\) for the term immunoglobulin and to apply \(\gamma\) to designate exclusively the heavy chains of immunoglobulin \(\text{G (IgG)}\). Symbols such \(\gamma\text{G}_1\), \(\gamma\text{D}\), etc., should be replaced by \(\text{IgG}_1\), \(\text{IgD}\), etc. The term \(\gamma\text{-globulins}\) should not be used as a synonym for immunoglobulins.

Use of the Symbols \(L\) and \(K\)

The symbol \(L\) is now being used in two senses, firstly as an abbreviation for light chains and secondly to designate that type of immunoglobulin molecules whose light chains are of the lambda variety. The intrinsic defect in this terminology becomes apparent in expressions such as ‘‘\(L\) chains of the \(L\) type’’ as opposed to ‘‘\(L\) chains of the \(K\) type.’’

It is therefore proposed to restrict the use of the symbol \(L\) to the designation of light chains as opposed to the symbol \(H\) for heavy chains and to discard the use of the symbol \(K\). The terms kappa type and lambda type should be used to indicate the type of whole molecules or isolated light chains formerly described as belonging to the \(K\) type and \(L\) type, respectively.

This amendment to the terminology proposed in 1964 also makes it necessary to discontinue the use of symbols such as \(\text{IgK}\) or \(\text{IgML}\), etc., which should be discarded in favor of notations such as \(\text{IgG}(\kappa)\), \(\text{IgM}(\lambda)\), etc.

Use of the Terms Classes, Subclasses, Types, Subtypes, Groups, and Subgroups

The previous proposals\(^4\) for the use of the terms classes, subclasses, types, and subtypes are retained. Specifically, these terms may be applied both to the entire molecule and to its chains.

The terms type and subtype designate variants of nonallotopic nature defined by characteristics of the constant (\(C_\lambda\)) regions of light chains. The terms class and subclass designate variants of nonallotopic nature defined by characteristics of the constant (\(C_\kappa\)) regions of heavy chains.

All variable regions associated with \(\kappa\) chains, \(\lambda\) chains, or \(H\)

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\(^2\) Reprints may be obtained from Dr. Waldo E. Cohn, Office of Biochemical Nomenclature, Biology Division, Oak Ridge National Laboratory, Post Office Box Y, Oak Ridge, Tennessee 37830.

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chains should be defined as forming a group. Three such
groups, to be called the V\textsubscript{e} group, the V\textsubscript{\lambda} group, and the V\textsubscript{\kappa} group, have so far been characterized. The variable regions from the V\textsubscript{e} group and the V\textsubscript{\lambda} group appear to be associated exclusively with constant regions from, respectively, k-type
and \lambda-type light chains. In contrast, the variable regions from the V\textsubscript{\kappa} group seem to occur in association with the constant
regions from any of the heavy chain classes.

Within a group of variable regions it is possible to distin-
guish a number of subgroups. It is now clear that the nomen-
clature earlier proposed for subgroups\textsuperscript{4} needs revision. Crite-
ria for the differentiation of subgroups are being developed
and will form the basis for future recommendations. Current
information can be obtained from Dr. F. Putnam, Chairman
of the Subcommittee on Human Immunoglobulins of the
International Union of Immunological Societies.

Similarly to the proposal for the terms class and subclass,
type and subtype, the terms group and subgroup may also
be used to characterize the variable region of the immunoglobu-
lin molecule.

Notes. These Recommendations have been prepared after consultation of the IUPAC-
IUB Commission on Biochemical Nomenclature (CBN).

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photoreproduction.

All Tentative Rules and Proposals of the IUPAC-IUB Commission of Biochemical
Nomenclature (CBN) are available from Waldo E. Cohn, Director, NRC Office of
Biochemical Nomenclature, Oak Ridge National Laboratory, Box Y, Oak Ridge, Tenn.
37830, U.S.A.

1. Abbreviations and Symbols for Chemical Names of Special Interest in Biological
Chemistry [see Biochem. J. (1966) 101, 1–7 (extended by items 6, 11 and 15 below)].

2. Nomenclature of Vitamins, Coenzymes and Related Compounds: Trivial Names
of Miscellaneous Compounds of Importance in Biochemistry, Nomenclature of
Quinones with Isoprenoid Side Chains, Nomenclature and Symbols for Folic Acid and
Related Compounds, Nomenclature of Corrinoids. Tentative Rules [see Biochem. J.
(1967) 102, 15–22 (but see item 10 below)].

3. Abbreviated Designation of Amino Acid Derivatives and Peptides [see Biochem. J.
(1967) 102, 23–27 (superseded by item 15 below)].

4. Rules for Naming Synthetic Modifications of Natural Peptides [see Biochem. J.

5. The Nomenclature of Lipids. A Document for Discussion [see Biochem. J. (1967)
105, 897–902 (for corrections see correction slip in Biochem. J. (1970) 116, issue no. 5)].

6. Abbreviated Nomenclature of Synthetic Polypeptides (Polymerized Amino Acids)
[see Biochem. J. (1968) 106, 577–579 (superseded by item 18 below)].


J. (1969) 113, 1–4].

113, 5–28 (for amendments see item 16 below)].

10. Nomenclature for Vitamins B\textsubscript{6} and Related Compounds. Tentative Rules [see
Biochem. J. (1970) 119, 1–4 (replaces M7 of item 2 above; superseded by item 20 below)].

11. Abbreviations and Symbols for Nucleic Acids, Polynucleotides and their
of item 1 above)].

12. Abbreviations and Symbols for the Description of the Conformation of Polypeptide

125, 673–695].

14. The Nomenclature of Multiple Forms of Enzymes. Recommendations [see
Biochem. J. (1972) 126, 769–771].

1975
15. Symbols for Amino Acid Derivatives and Peptides [see Biochem. J. (1972) 126, 773–780 (supersedes item 3 above; for corrections see Biochem. J. (1973) 135, 9)].

16. Amendments to Rules for Nomenclature of Steroids [see Biochem. J. (1972) 127, 613–617 (amendments to item 9 above)].


A document, OBN-5, describing the (American) NRC Office of Biochemical Nomenclature, and listing other rules affecting biochemical nomenclature, is available from its Director, Dr. Waldo E. Cohn [see also J. Chem. Doc. (1967) 7, 72–73; (1969) 9, 235–241].