

# Water in Organic Synthesis

*... from the Science of Synthesis Reference Library*

## *Editorial Guidelines*

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## Preface

### Science of Synthesis

*Science of Synthesis, Houben–Weyl Methods of Molecular Transformations* was launched in 2000 and is edited by D. Bellus (Basel, Switzerland), E. N. Jacobsen (Cambridge, USA), S. V. Ley (Cambridge, UK), R. Noyori (Nagoya, Japan), M. Regitz (Kaiserslautern, Germany), P. J. Reider (Princeton, USA), E. Schaumann (Clausthal-Zellerfeld, Germany), I. Shinkai (Tokyo, Japan), E. J. Thomas (Manchester, UK), and B. M. Trost (Stanford, USA). *Science of Synthesis* is a balanced and critical reference work produced by the collaborative efforts of chemists, from both industry and academia, selected by the Editorial Board. All published results from journals, books, and patent literature from the early 1800s until the year of publication are considered by the authors, who are among the leading experts in their field, to provide chemists with the most reliable methods to solve their synthesis problems.

*Science of Synthesis* is organized in a logical hierarchical system based on the target molecule to be synthesized. The critical coverage of methods is supported by information intended to help the user choose the most suitable method for their application, thus providing a strong foundation from which to develop a successful synthetic route. Within each category of product, illuminating background information such as history, nomenclature, structure, stability, reactivity, properties, safety, and environmental aspects are discussed along with a detailed selection of reliable methods. Each method and variation is accompanied by reaction schemes, tables of examples, experimental procedures, and a background discussion of mechanistic rationale, stereochemistry, scope of the reaction described and its limitations, and functional group compatibility. In a format consisting of 48 volumes, *Science of Synthesis* is a unique reference work, selecting and evaluating all synthetic methodology and thus providing more than just a compound database or an indiscriminate review of the literature.

To best meet the needs of the scientific community, *Science of Synthesis* is being published as an electronic version and also in print.

### Science of Synthesis Knowledge Updates

From 2010 onwards, the organic chemistry reference series *Science of Synthesis* will be continuously updated with high-quality content using clearly defined criteria for method selection as well as established editorial processes. The Editorial Board, in conjunction with selected volume editors and authors, will review the whole field of synthetic organic chemistry as presented in *Science of Synthesis* and evaluate significant developments in synthetic methodology.

The series will be edited by E. M. Carreira (Zurich, Switzerland), C. P. Decicco (Princeton, USA), A. Fürstner (Mülheim, Germany), G. A. Molander (Philadelphia, USA), P. J. Reider (Princeton, USA), E. Schaumann (Clausthal-Zellerfeld, Germany), M. Shibasaki (Tokyo, Japan), E. J. Thomas (Manchester, UK), and B. M. Trost (Stanford, USA).

A list of strict criteria for method selection will guide the updating process in order to guarantee that only the best and most reliable synthetic methods are included in *Science of Synthesis*. Authors involved in the updating process will add new methods and add new (or completely revise existing) product (sub)classes.

The updating procedure will be continuous and new content will be added to the electronic version in four releases per year. *Science of Synthesis* will continue to be the most up-to-date evaluated electronic reference work available, emphasizing the most significant developments in synthetic methodology.

*Science of Synthesis* will give convenient access to a century of synthetic organic chemistry starting with the first volume of *Houben–Weyl* published in 1909 right through to groundbreaking methodology added immediately upon validation by experts. The electronic version's intuitive interface will adapt in keeping with the latest technological developments and will enable chemists worldwide in both academia and industry to solve complex synthetic problems.

### **Science of Synthesis Reference Library**

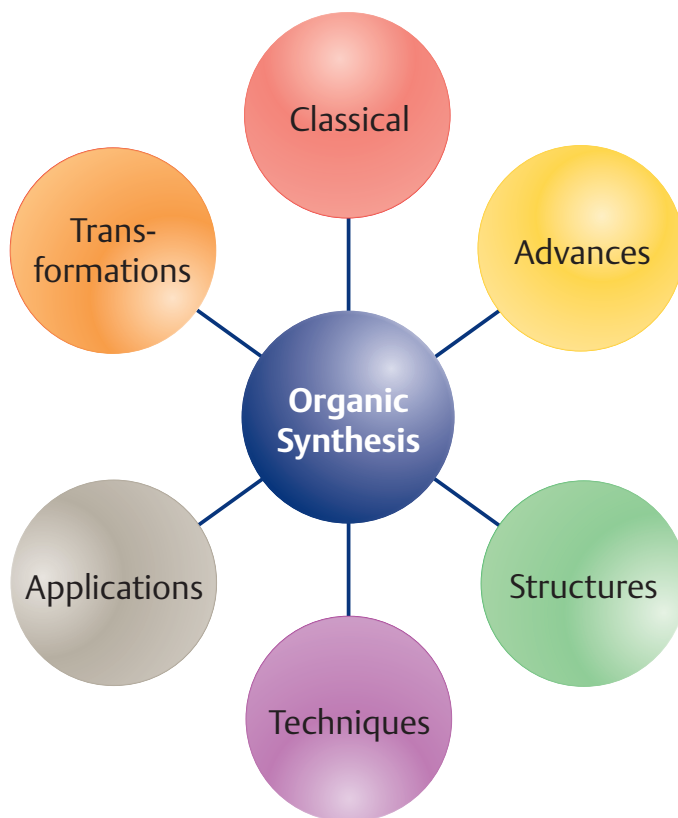
From 2010 onwards, the organic chemistry reference series *Science of Synthesis* will be complemented by a variety of organic synthesis specialist topic reference works which will constitute the *Science of Synthesis Reference Library*. A modular approach will be used to build the reference library using six main classifications: (1) Classical, (2) Advances, (3) Transformations, (4) Applications, (5) Structures, and (6) Techniques.

*Science of Synthesis* is organized by product topology (1D). The *Science of Synthesis Reference Library* will be designed so that where possible it incorporates reaction type. This additional content will be complementary to the existing scaffold of core synthetic methodology available and will provide a "2D" approach in terms of product design.

The *Science of Synthesis Reference Library* will be developed in collaboration with Members of the *Science of Synthesis* Editorial Board who will help with the identification and selection of topics as well as provide guidance in relation to the scientific content and format of presentation of the product. World renowned experts will be chosen to author the contributions. The high editorial quality standards associated with *Science of Synthesis* will be maintained and the product will be made available in both print and online formats.

The Publisher

## Science of Synthesis Reference Library – A Modular Structure



Science of Synthesis Reference Library Publication Schedule and Modules

Science of Synthesis Reference Library	Publication	Classical	Advances	Transformations	Applications	Structures	Techniques
Stereoselective Synthesis: Reactions of Carbon–Carbon Double Bonds	2010			✓			
Stereoselective Synthesis: Reactions of Carbonyl and Imine Groups	2010			✓			
Stereoselective Synthesis: Cross Coupling, Pericyclic Reactions, C–H/C–X Activation	2010		✓	✓			
Water in Organic Synthesis	2011		✓	✓			
Asymmetric Organocatalysis	2011		✓	✓	✓		

## ***Water in Organic Synthesis – An Insight***

### **Editorial Description**

More and more chemists today are becoming curious about the use of water in organic synthesis, because there are many advantages linked with using such a safe and inexpensive solvent. Although the organic chemist has tended to shy away from using water in the past, it is now imperative that one understands how it might be used in organic synthesis. *Water in Organic Synthesis* is essential for the organic chemist in helping gain a thorough appreciation of the latest and most reliable and available methods for using water in organic synthesis. It helps illustrate how water can often be a viable and green solvent in the laboratory.

We would like to provide a logical and didactical structure to format this work. Together with our team of expert authors, we aim to give the ultimate resource for the organic chemist on the topic of water in organic synthesis.

This volume provides the reader with a detailed introduction to the subject: background information, evaluated methods, practical applications, industrial applications, special techniques, and an overview of the latest trends. There is a systematic and comprehensive treatment of the subject and a focus on the provision of pertinent information.

Water is a beautiful solvent, and *Water in Organic Synthesis* helps not only to illustrate this, but it should also help in inspiring chemists worldwide to find new approaches and techniques for its application in organic synthesis. We can be certain that this topic is going to become the focal point of many future projects and studies across a spectrum of research fields especially if we consider the important role that water plays in nature. Only through a real understanding of how water interacts, its properties, structure, and reactions, can we really begin to appreciate this molecule that is of course of vital importance to humanity.

Shu Kobayashi

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# 1 **Water in Organic Synthesis**

## 1.1 **Introduction**

The **title, subject, and scope** of the assigned contribution are to be clarified with the volume editor.

**Table of Contents.** In order to minimize overlap and duplication of information within the contributions please submit a table of contents to the volume editor with a copy to the Editorial Office (an e-mail is sufficient: science-of-synthesis@thieme.de).

**Coverage.** The aim of *Water in Organic Synthesis* is to provide the readers with a critical review of the methodology chosen and to present the contribution in an informative and readable style.

1. Authors should not exceed the number of pages agreed upon in the Contributing Author's Agreement and should try to be as concise as possible in their coverage of a particular subject area. However, should an amendment to the number of pages agreed upon be unavoidable because significant new results are available then the responsible volume editor must be informed immediately. A decision can then be made between the volume editor and Publishing House about the best way to proceed.
2. Where possible, cross-references to methodology described in *Science of Synthesis* and *Houben-Weyl* should be included.
3. Also, to further help coordinate activities, authors will be sent a complete list of contributors and section numbers for the volumes in the series to help with cross-referencing within the *Water in Organic Synthesis* volumes themselves.

**Language.** All parts of *Water in Organic Synthesis* will be written in American English. All parts of the manuscript should be written in the *present* or *relevant* tense, except for the *experimental procedures*, which should be written in the *past tense*. For further details on the style of the manuscripts please see Section 3.3.2.

**Sample Contributions.** Two sample contributions will be prepared and sent to all authors to help as a guide regarding the styles and conventions used in *Water in Organic Synthesis*. Any queries with regard to these sample contributions should be addressed to the volume editor.

## 1.2 **Objectives and Scope**

*Water in Organic Synthesis* is a one-volume work to be published by Thieme Chemistry in 2011. The organization of *Water in Organic Synthesis* is based on synthetic methods, which are arranged according to the type of reaction. Each contribution covers a specific methodology, so that the hierarchy of the work is kept as flat as possible. Each contribution is thematically homogeneous, and the contribution authors are acknowledged experts on the topic in question.

A typical contribution in *Water in Organic Synthesis* would include the following aspects:

Reaction To Be Described, e.g. Hydrosilylation of Carbon–Carbon Double Bonds

Introductory Text

- Background Information (e.g., history, nomenclature, applications)
- Robustness
- Scalability
- Safety and Environmental Aspects
- Yield
- Scheme/s

Mechanism

- Background Information
- Scheme/s

Method/s

- Background Information (e.g., history)
- Stereochemistry
- Scope
- Limitations and Problems
- Scheme/s
- Table of Examples
- Experimental Procedures

References

The exact order in which these aspects are discussed in terms of subsections is at the discretion of the author, subject to the approval of the volume editor. However, no more than six hierarchical levels of subsections should be used (i.e., the volume number, the contribution section number, and then up to four more subdivisions).

Imperative to the success of the project is the quality of the contribution submitted by the author and the attempt to critically review all methods and rank them.

Articles written in the style of monographs or textbooks do not comply with the requirements of *Water in Organic Synthesis*. The manuscript must be written according to the organizational principles as explained in the Editorial Guidelines for *Water in Organic Synthesis*.

### 1.3 Selection Criteria

- *Water in Organic Synthesis* is exclusively oriented toward synthesis and the selection of the best and most reliable synthetic procedures. All synthetic methodology reported should be checked for the synthetic importance of the synthesized compound, the ease of execution, the yield of reaction, the cost of the reaction, green issues, and also whether there are easier methods available for the synthesis of a certain compound.
- A reaction can be of high mechanistic and theoretical interest, but this is not a sufficient criterion for inclusion in *Stereoselective Synthesis*.
- A synthetic method may be very interesting from the point of view of the mechanism, but if there is an easier and less expensive alternative then only this will be reported. The interesting alternative may or may not be mentioned.
- Authors are encouraged to report synthetic methods which would typically have been successfully applied to six different compounds with good yields. Methods that have only been reported for two or three compounds with varying yields need to be further evaluated.

- For all methods, references to the pertinent literature should be given. Important references to a particular procedure should also be given and reference to other tertiary reference works should be avoided.

#### 1.4 Requirements for Final Manuscript Submission

The final manuscript as approved by the volume editor should be submitted to the Editorial Office by e-mail to: science-of-synthesis@thieme.de.

The manuscript should take the following format:

##### 1.4.1 Text Folder

This folder should contain an MS Word file of the manuscript.

- **Title Page** [including author(s), full postal address(es) of the author(s), e-mail address(es) of the author(s)]
- **Table of Contents**
- **Abstract** consisting of 10–15 lines summarizing the content
- **Keywords** i.e. 1–3 per page
- **List of Abbreviations and Symbols** used
- **Body Text** with places for insertion of schemes, figures, and tables clearly labeled. All pages should be numbered with Arabic numerals.
- **References** should be placed collectively at the end of the text and should be numbered consecutively within chapters, with no subdivisions such as <sup>[3 a]</sup>, <sup>[3 b]</sup>, <sup>[3 c]</sup>, etc. Each reference number should contain only one citation. For further guidelines on the presentation and format of references please see Section 3 (Manuscript Preparation).

*General:* Compound numbers should only be used if the compound is referred to in the text. Where the full name of a compound is given, the compound number should appear emboldened in parentheses [e.g., (S)-butan-2-ol (**23**)]. If the full name isn't given then the number simply appears in bold, no parentheses (e.g., alcohol **23**).

Not all structures need to have a compound number. Only products of experimental procedures *must* have a compound number. All compound numbers should be referred to somewhere in the text.

Abbreviations should not be used in the running text (e.g., CO should read carbon monoxide). Abbreviations should only be used in the experimental sections (and in schemes and tables).

Schemes and figures should not be electronically embedded in the text. They should be indicated in the text using Arabic numerals as follows:

<**Scheme 1**> Scheme Title<sup>[ref]</sup>

<**Figure 1**> Figure Title<sup>[ref]</sup>

*Scheme:* A graphic containing chemical structures (not only chemical reactions).

*Figure:* A graphic containing pictorial information such as chemical apparatus or an NMR spectrum.

### 1.4.2 Graphics Folder

This folder should have multiple chemical drawing files (preferably ChemDraw) which contain figures and schemes that are to be inserted into the body of the text. For details on the appearance of figures and schemes as well as the *Water in Organic Synthesis* ChemDraw settings please see Section 3 (Manuscript Preparation).

If necessary, please contact the Editorial Office ([science-of-synthesis@thieme.de](mailto:science-of-synthesis@thieme.de)) for a copy of the *Science of Synthesis* ChemDraw template.

A **graphic abstract**, visually summarizing the contents of the contribution with a chemical equation or illustration, will be used to allow browsing in the electronic version. Please do not forget to include this abstract and identify it clearly.

## 2 People

### 2.1 Roles of the Participants

#### 2.1.1 The Volume Editor

The tasks of the volume editor include:

- consulting duties and strategic planning;
- preparation of a complete concept for the *Water in Organic Synthesis* project;
- approval of the basic concept of the *Water in Organic Synthesis* project;
- participation at any Volume Editor Meetings organized by the publisher;
- the recruitment of authors (contributing authors) for the volume;
- coordination and monitoring of the deadlines;
- the monitoring of the manuscripts, illustrations, and artwork received, in particular for their suitability, scientific content, completeness, and conformance to the publisher's guidelines and the requirements of the contract;
- indicating any necessary changes, additions, or abridgments of the manuscripts, illustrations, and artwork, if the contributing authors are not willing or able to do so;
- giving the Imprimatur for each part of the volume;
- informing the publisher regularly (at least quarterly, and also at any time at the publisher's request) comprehensively about the state of the volume/contributions;
- assisting the publisher in marketing and promotion activities.

#### 2.1.2 The Authors

The tasks of the authors include:

- adhering to the specifications contained in the Editorial Guidelines. The contributing author shall furthermore take into consideration the recommendations and ideas of the volume editor and of the publisher with regard to editorial, stylistic, and professional aspects;
- writing the contribution in such a way that it corresponds to the latest state of facts or knowledge and/or state of scientific discussions of the field or subject dealt with;
- meeting all deadlines set. The deadlines set for each of the contributions will depend on the size of the manuscript and might span three to nine months;
- providing copies of texts and/or illustrations of third parties, which may be required for the completion and/or illustration of the contribution, provided that they do not have to be provided by the volume editor;
- providing clear and correct representations of formulas, reaction equations, and reaction schemes in electronic form. The publisher will advise the contributing author concerning the optimal form of presentation. The publisher is authorized to rework the artwork (graphics) in order to improve the presentation or to make it consistent with the overall style of the work;
- carrying out their duties in good cooperation with potential coauthors of the contribution and additional authors of *Water in Organic Synthesis* as well as in close contact with the volume editor and the publisher, and, at request, informing the volume editor and the publisher at any time about the status of the contribution;
- giving the Imprimatur for their contribution.

### 2.1.3 **The Editorial Office**

The tasks of the Editorial Office include:

- assisting the volume editor during the volume planning process;
- providing monthly status reports on the progress of the volumes to the volume editor;
- sending an author's agreement to the author at the volume editor's request;
- setting publication dates and targets;
- coordinating and monitoring deadlines;
- copyediting the revised draft manuscript according to *Water in Organic Synthesis* house style;
- sending copies of the page proofs to the volume editor and author;
- proofreading the page proofs and making any necessary corrections (including those indicated by the volume editor and author);
- preparing and checking the covers, title pages (indexes if necessary), and other aspects of the final published contribution and/or volume.

## 2.2 The Participants

### 2.2.1 The Volume Editor

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## 3 Manuscript Preparation

The publication of *Water in Organic Synthesis* as an electronic version demands absolute consistency of structure and style for the manuscripts. Authors are therefore requested to carefully read and follow the instructions for authors. Furthermore, manuscripts of the appropriate length and style will help to reduce costs and time-consuming editing. Only manuscripts perfect in style will be suitable for the production of the electronic version of *Water in Organic Synthesis*.

### 3.1 General Criteria

*Water in Organic Synthesis* will critically evaluate the methods that are of most significance for modern organic synthesis. Please see Section 1.3 for the *Water in Organic Synthesis* selection criteria.

Books, journals, and the patent literature must be considered equally. References to patents should be given whenever they contain relevant information.

### 3.2 Disposition of the Manuscript

The volume editor will specify a general outline for the volume which will serve as a guideline to all authors. Authors will be recruited by the volume editor. Authors will then submit for approval to the volume editor a table of contents according to the general outline. **The authors are requested not to exceed the given number of printed pages for their manuscripts. The authors are asked to contact the volume editor and the Editorial Office if their manuscripts differ significantly from the agreed length.** For estimating the final length of a contribution, the following general rules should be used (assuming that the author has used the document template):

- 1 typewritten page = 24 lines of 75 characters
- 1 printed page = 3 typewritten pages (without schemes and tables)  
= 2 typewritten pages (with schemes and tables)

### 3.3 Guidelines for Text

#### 3.3.1 Format of Text

Authors must produce their text with word processors. The text should be typed with 1.5 times spacing (at least 5 mm between lines) in all parts of the manuscript (including references, scheme captions, and tables) and wide margins (ca. 2 cm at top, bottom, left- and right-hand side of each page). We recommend ca. 75 characters per line in a large proportional script (e.g., 12 point Times New Roman). Underlining, indentations, and block capitals should be avoided. Boldface and italic fonts should be used according to the instructions [e.g., amine **6**; *J. Org. Chem.*, (1973) **38**, 3438]. References, schemes, and figures (in this order) should be included at the end of the manuscript. Tables should be included in the appropriate position in the body of the text. All pages including author's address, contents, text, references, and tables must be numbered consecutively. Tables, schemes, formulas for tables, and figures should be numbered with Arabic numbers, not Roman numerals.

### 3.3.2 Style of the Manuscripts

- Use American spelling according to *Webster's Dictionary* [Merriam-Webster: Springfield MA, (1990)].
- For style of the manuscripts the *ACS Style Guide* [*The ACS Style Guide*, 2nd ed.; Dodd, J. S., Ed.; American Chemical Society: Washington D. C., (1997)] should be consulted.
- Authors should indicate trademarks and registered trademarks by capitalization of the first letter.
- All parts of the manuscript should be written in the **present** or **relevant** tense, except for the **experimental procedures**, which should be written in the **past** tense.

### 3.3.3 Nomenclature

In *Water in Organic Synthesis*, systematic names will be given only to selected examples. "Correct" nomenclature should be used, **based on the rules of IUPAC** [see *A Guide to IUPAC Nomenclature of Organic Compounds: Recommendations 1993*, Blackwell Scientific: Oxford, (1993)]. Whilst the IUPAC system is preferred whenever possible, names based on the systematic rules adopted by Chemical Abstracts (Appendix IV of the current Chemical Abstracts Index Guide) will be accepted if necessary. **Do not use a mixture of both systems**, either within the same name or anywhere within the manuscript. An exception is the naming of ring systems, whose names and numberings may be taken or derived from the *Ring Systems Handbook* [American Chemical Society: Columbus OH, (1988) and supplements]. For biochemical nomenclature see *Compendium of Biochemical and Related Documents*, Portland: London, (1992). Nomenclature for inorganic compounds is provided by the corresponding IUPAC rules [*Nomenclature of Inorganic Chemistry*, 1970, Butterworths: London, (1971), and *Recommendations, 1990*, Blackwell Scientific: Oxford, (1990)]. Names of common reagents and solvents are to be retained, e.g. diethyl ether. Trivial names should be avoided unless they offer a distinct advantage over the corresponding systematic name. For classes of complex natural compounds, such as carbohydrates, peptides, or steroids, the most common name should be given. Compounds which are not named or have long names should be referred to unambiguously as "amine **2**" or "thioester **14**". In matters of style, i.e. which words or prefixes are hyphenated, italicized, capitalized, etc., consult the *ACS Style Guide* [*The ACS Style Guide*, 2nd ed.; Dodd, J. S., Ed.; American Chemical Society: Washington D. C., (1997)].

### 3.3.4 Units

- For pressure, Torr, atm, or Pa are to be used [note: 1013.25 mbar = 760 Torr = 101 325 Pa = 14.696 psi].
- For temperature, use °C. For very low temperatures, K is also acceptable.
- Metric units (SI) should be used in all other cases, although the unit kcal will also be accepted.

### 3.3.5 Abbreviations

- Abbreviations and simple chemical formulas (e.g., CH<sub>2</sub>Cl<sub>2</sub>) should be used in tables, schemes, and experimental procedures.
- Do **not** use abbreviations in titles or the discussion text.
- Common abbreviations used in *Water in Organic Synthesis* are given in tables to be found in the Appendix.

### 3.3.6 Experimental Procedures

- Experimental procedures should follow the style of the Thieme journal *SYNTHESIS*.
- The experimental procedure itself is entitled with the product, or general classification of the product name, followed by the compound number.
- All experimental procedures should be classified as one of the following:
  1. General Procedure: A generalized version of a widely applicable experimental procedure.
  2. Typical Procedure: A specific example of a widely applicable experimental procedure.
  3. Single Procedure: Single procedures are not to be labeled, but are defined as follows: A specific experimental procedure for a single compound which is not applicable to similar compounds or for which the scope has not been studied.

As the criteria used to assess experimental procedures include range of applicability, the majority of procedures will be Typical or General Procedures; nontypical procedures for individual examples are restricted to unique methods that are particularly useful for the synthesis of one synthetically important compound or intermediate.

- All titles of experimental procedures should have a reference citation.
- The author should indicate aspects of the procedure which are particularly critical to success, including any new observations on or adaptations of older literature methods.
- Available details of workup should be included.
- Authors are encouraged to specifically discuss if a described method has proven to be useful for solid-phase reactions.
- Physical or spectroscopic data should be given only to a very limited extent. Authors should choose **significant** spectroscopic data (e.g., shifts of important NMR signals) of the products. These data should help chemists to repeat the procedures and identify the products.
- The slash symbol is to be used for (1) surfaces, e.g. Pd/C; (2) alloys and amalgams, e.g. 5% Na/Hg, Na/K (1:1); (3) solvent mixtures, e.g. EtOH/MeOH (95:5); (4) reagent concentrations, e.g. 2% HCl/H<sub>2</sub>O; (5) single reagents, e.g. Li/NH<sub>3</sub>.
- Write procedures in the **past** tense and include the mass, number of moles, volume, etc., in brackets **after** the name of the substances or solvents.
- Avoid starting sentences with numbers, wherever possible.
- Procedures from preparative book series, such as *Organic Syntheses* are **not allowed** for reproduction. If necessary, a short comment on relevant procedures of the same type should be made.

#### 3.3.6.1 Example Experimental Procedure

Tributyl[(2*R*)-3-(methoxymethoxy)-2-methylpropyl]stannane (4); Typical Procedure:<sup>[25]</sup>

**CAUTION:** *Technical grade chloromethyl methyl ether is classified as a human carcinogen, and is an eye and respiratory tract irritant.*

A soln of crude **3** (7.3 g, from 15 mmol of **2**) in THF (40 mL) was cooled in an ice bath and NaOH (1.5 g, 37 mmol) in H<sub>2</sub>O (8 mL) was added, followed by dropwise addition of 30% H<sub>2</sub>O<sub>2</sub> (5 mL, 50 mmol). The mixture was kept at 0 °C for 1 h, and then at 25 °C for 6 h, during which time a pasty, colorless precipitate formed. The mixture was treated with Et<sub>2</sub>O (50 mL) and filtered. The aqueous phase was separated and extracted with Et<sub>2</sub>O (3 × 30 mL) and the combined organic phase was dried (MgSO<sub>4</sub>) and concentrated. The gel-like residue was flash chromatographed [silica gel, petroleum ether (bp 30–40 °C)/Et<sub>2</sub>O 9:1] to give the labile intermediate; yield: 3.98 g (76%); this was reacted further without characterization. To a soln of the intermediate (3.6 g, 10 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (10 mL) was added iPr<sub>2</sub>NEt (1.2 g, 10 mmol), followed by MOMCl (0.89 g, 11 mmol). The mixture was stirred for 1 h at 0 °C and 15 h at 25 °C,

and then concentrated. The resultant residue was treated with ice-cold 2 M HCl (10 mL) and extracted with petroleum ether (bp 30–40 °C; 2 × 20 mL). Concentration of the organic phase (10 Pa) gave the product as a colorless solid; yield: 3.7 g (92%); mp 130 °C.

### 3.3.7 Safety

Chemicals are associated with two types of hazard: hazards that are a direct result of the physical or reactive properties of a chemical; and hazards posed by the effect of a chemical on biological systems. Flammability and the stability of a chemical in air or toward water may be included in the first group, while the carcinogenic potential of a chemical or its effect on the reproductive system are health hazards due to the biological properties of a chemical. The different hazardous properties that authors should take into consideration when evaluating experimental procedures are as follows:

#### Physical and reactive chemical hazards:

- Flammability
- Explosive properties
- Stability in air or in contact with water (pyrophoric and water-reactive compounds)
- Incompatibility with commonly available chemicals and reagents
- Potential for peroxidation
- Oxidizing or reducing properties
- Storage properties

#### Health effects of chemicals:

- Known human carcinogens and probable human carcinogens according to the International Agency for Research on Cancer (IARC) classifications
- Known human teratogens
- Chemicals known to have an effect on human reproduction
- Chemicals that are irritants to the skin, eyes, and respiratory system (data from human exposure or animal tests)
- Chemicals that are corrosive to the skin, eyes, and respiratory system (data from human exposure or animal tests)
- Skin sensitizers
- Chemicals that are highly toxic as a result of some specific pharmacological mechanism (e.g., the potent neurotoxin tetrodotoxin)

Hazard information may be found in:

Rhodes, P. H., *The Organic Chemist's Desk Reference*, Chapman & Hall: London, (1995); pp 112–126.

Urban, P. G., Ed., *Bretherick's Handbook of Reactive Chemical Hazards*, 6th ed., Butterworth-Heinemann: Oxford, (1999).

Luxon, S. G., Ed., *Hazards in the Chemical Laboratory*, 5th ed., Royal Society of Chemistry: Cambridge, (1992).

It is important that authors discuss potential hazards of the described compounds. Furthermore, the methods described in *Water in Organic Synthesis* should be discussed in terms of atom economy, as well as their possible impact on the environment. If toxic solvents (e.g., chloroform), toxic catalysts [e.g., mercury(II) chloride], toxic reagents (e.g., phosphene), or any other hazardous compounds are used or recommended in certain experimental procedures, alternatives should be discussed. Safety guidelines should be given for dangerous compounds or procedures. Warnings in experimental procedures should be given using the following format:

**CAUTION:** Hexamethyltungsten(VI) is known to decompose explosively. Proper safety precautions should be taken during its synthesis, storage, and handling.

### 3.3.8 Copyright

It is the responsibility of the author to obtain, where necessary, copyright permission for figures (see Section 3.7), tables, schemes, or textual information from another source that is to be reproduced in a *Water in Organic Synthesis* contribution. The Editorial Office can always be contacted for advice on such matters, and will help authors to direct applications to the appropriate departments. In the case of reproduction of experimental procedures and schemes from journal publications, a full citation in the references section is sufficient acknowledgement of copyright ownership. Problems concerning copyright infringement usually arise when text or figures are taken from books [e.g., Brandsma, L.; Verkruijse, H. D., *Synthesis of Allenes and Cumulenes*, Elsevier: Amsterdam, (1981)] or serial publications [e.g., *Organic Syntheses, Coll. Vol. VI*, Noland, W. E., Ed; Wiley: New York, (1988)] without significant adaptation of the original version. The copy editor assigned to each manuscript will advise the author of the need to obtain copyright, if they have not already done so, and will add the appropriate credit line. If there is an appropriate and adequate alternative to a reference requiring copyright then this reference should be substituted, or if a similar procedure is available then this procedure should be used instead of that under copyright. Permission request forms are in the author's information package or can be obtained from the Editorial Office.

### 3.4 Guidelines for References and Cross-References

- References should be placed collectively at the end of the text (in Part 4 of your manuscript, entitled “References”).
- References should be numbered consecutively within chapters, with no subdivisions such as <sup>[3a]</sup>, <sup>[3b]</sup>, <sup>[3c]</sup>, etc.
- *Each reference number should contain only one citation.*
- Use one reference number for each reference only; do not repeat a reference citation with a new number every time it appears.
- References to literature appear in the text, tables, and scheme headings as superscript 10 pt Arabic numerals in square brackets following the punctuation, e.g. This is a sample sentence.<sup>[1]</sup>
- Authors should include reference numbers for schemes and figures in the scheme/figure caption.
- Reference numbers for tables should be included in the tables as the final column, with the heading Ref.
- *Journals*: provide the names of **all** authors. Do not use “et al.”. A comma should be used to separate the name of the last author and the title of the journal.
- Use the journal abbreviation in accordance with the approved list given in Section 4.2. This is based on that of *Chemical Abstracts* [*Chemical Abstracts Service Source Index (CASSI) 1907–1994 Cumulative* and its supplements].
- *Books*: see sample references for books with and without editors.
- *Patents*: see sample reference. Important patents should be read in the original versions as *Chemical Abstracts* reports often do not contain all important details.
- *Databases*: reference can also be given to records in databases (e.g., spectra from databases such as Specinfo).
- If reference is made to a patent or less readily available journal, the *Chemical Abstracts* reference or the English translation [e.g., *J. Gen. Chem. USSR (Engl. Transl.)*] should also be cited.
- *Science of Synthesis* will support the citation of electronic journals. As soon as general document identifiers for journal articles are available, the editorial office will include them to allow users direct access to these references.

- The use of a reference-managing program (e.g., EndNote) is strongly recommended (note, however, that use of the endnote function in MS Word is *not* recommended).
- References to *Houben–Weyl* should only be given if it is not possible to substitute these with a cross-reference in the running text. References to *Science of Synthesis* should be avoided: always give a cross-reference in these cases.
- Cross-references to *Houben–Weyl* include the volume and page number, whereas those to *Science of Synthesis* include the volume and section number, e.g. *Houben–Weyl*, Vol. 13/9b, pp 632–700 or *Science of Synthesis*, Vol. 10 [Fused Five-Membered Heteroarenes with One Heteroatom (Section 10.1.1.3.1.4)].

### 3.4.1 Sample References

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### 3.5 Guidelines for Tables and Scheme Tables

#### Tables

Tables should be used to display examples of similar products prepared by a given method or variation in order that they may be critically discussed in the text.

**Do not list every example known; only selected examples should be given.**

Tables should contain 5 to 10 examples and should be placed in the appropriate position in the body of the text. Tables should be numbered with Arabic numerals and have captions with initial letters of major words capitalized. When referring for the first time to information given in a table, please quote the table number in brackets. The position of a table should be indicated in the text in the following way:

<Table 1> This is a Sample Caption<sup>[33]</sup>

In tables, collect comparable examples and quote, in the following order:

1. The starting material represented pictorially, e.g. either present a generalized equation above and then give only substituents R<sup>1</sup>, R<sup>2</sup>, X, etc. (see below) or, in the case of structurally diverse substrates, give the entire formula. An entry number is also acceptable for identifying the starting material. In all cases, arrange the examples

in a manner which best illustrates the scope and limitations of the method (e.g., they may be listed in increasing order of substituent/reagent complexity, or in increasing order of chemical or optical yield, etc.).

2. Reagents, solvents, temperature, times, as applicable.
3. Product (formula or entry number).
4. ee, er (preferred), dr when applicable.
5. Yield data.
6. Physical data, if relevant (e.g., mp).
7. Citation of the relevant literature.

<Table 1> Caption<sup>[ref nos]</sup>

Starting Material or Entry	Reaction Conditions I	Reaction Conditions II	Product	er or dr	Yield (%)	Ref
(formula or entry number)	(reagents, catalysts, solvents)	[Temp (°C), pressure (Torr)]	(formula or R groups)			

### Scheme Tables

Scheme tables should be employed in conjunction with schemes if the latter are likely to become overcluttered with textual notes. Scheme tables should not contain entry numbers. They should be used to illustrate methods (or variations) when (1) there are several examples for the method but they are not actively and individually discussed in the main text, and thus presented in a normal table (see above); (2) there are fewer examples but they contain several varying R substituents on the reagent(s) in the scheme; (3) there are different conditions (e.g., solvent, temperature, ratio of reactants) employed for the same reaction which have a significant influence on the yield, purity, or optical purity, etc. of the product. All other cases should simply include the examples within the scheme itself (see below).

The content and layout of a scheme table should be similar to that employed for a table, and in all cases kept as simple as possible. An example of a scheme table is given below:

**Scheme 12** Oxidation of Aryl Sulfides with Hydrogen Peroxide in the Presence of Various Catalysts<sup>[54–58]</sup>

Ar <sup>1</sup>	R <sup>1</sup>	Conditions/Catalyst	Yield (%)	Ref
4-ClC <sub>6</sub> H <sub>4</sub>	Me	H <sub>2</sub> O <sub>2</sub> , VO(acac) <sub>2</sub> , EtOH, rt	90	[54,55]
Ph	Ph	UHP <sup>a</sup> , Re(PPh <sub>3</sub> ) <sub>2</sub> OCl <sub>3</sub> , MeCN	92	[56]
Ph	Ph	H <sub>2</sub> O <sub>2</sub> , TiCl <sub>3</sub> , EtOH, rt	100	[57]
Ph	Et	H <sub>2</sub> O <sub>2</sub> , TeO <sub>2</sub> , HCl, MeOH	92	[58]

<sup>a</sup> UHP = urea–hydrogen peroxide adduct.

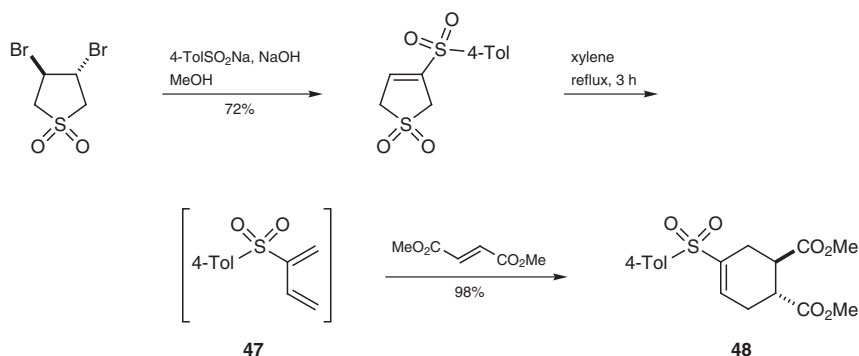
Scheme tables should be placed below the relevant scheme heading in the body of the text, i.e. they should be included as part of the word processor document. Scheme tables will not have a caption but should be headed <Schemetable n> where n is the same number as the corresponding scheme.

### 3.6 Guidelines for Schemes

- The schemes should be visual abstracts of the reactions performed, hence flow diagrams are preferred to individual structures.
- Schemes should be numbered with Arabic numerals and have captions with initial letters of major words capitalized.
- When referring for the first time to information given in a scheme, please quote the scheme number in brackets.
- A scheme should be indicated in the text in the following way:  
<Scheme 1> This is a Sample Scheme<sup>[10]</sup>
- Schemes should be placed separately at the end of your manuscript. Schemes and figures must be submitted on a separate sheet. They should **not** be electronically embedded in the text.
- Schemes should not exceed a width of 16 cm; schemes wider than this will not be accepted.
- Reaction arrows normally should be oriented horizontally, using more than one "line" if necessary. If there are still space constrictions, arrows oriented vertically or at 45° angles may be permitted. Authors should try to make efficient use of the space.
- Products of experimental procedures (and substrates and intermediates that are referred to in the text) should be numbered with bold Arabic numbers from left to right in sequence as they appear in the schemes. Begin from 1 at the start of each manuscript.
- Not every compound in a scheme needs to have a number. However, the title compound in an experimental procedure should have a number.
- For compounds with varying substituents, the labels R<sup>1</sup>, R<sup>2</sup>, X, etc. must be used and defined in a table or scheme table. Do not use R without a superscript.
- Use <sup>+</sup> and <sup>-</sup> (i.e., plus and minus symbols as superscripts) for electric charges (do not circle them).
- Two dots should be used to indicate a lone pair.
- Reagents, conditions, etc., should appear above the arrow, only.
- Unstable intermediates should be drawn in square brackets (see below).
- Each individual reagent, condition, etc., should be separated from the next by a comma and one character space, not a semicolon or solidus (forward slash); no comma should appear at the end of a line.
- Reagents, conditions, etc., appear in the following order:
  - (1) Reagents, including catalysts, e.g. H<sub>2</sub>(g), Pd/C, Pd(PPh<sub>3</sub>)<sub>4</sub>.
  - (2) No. of equivalents.
  - (3) Solvents.
  - (4) Special apparatus, e.g. sealed tube, autoclave.
  - (5) Temperature, e.g. rt, 50 °C, reflux.
  - (6) Pressure, e.g. 5 atm, 100 Pa.
  - (7) Time, e.g. 5 min, 6 h, 12 d.
- Eliminated products (preceded by a minus sign) and the reaction yield appear below the arrow.
- Please do not use wedged bonds (bold or hashed) to represent chiral centers; use normal bold or hashed bonds instead.
- References will not appear in schemes but in the scheme headings.
- For intermediates in schemes the following rules apply:
  1. Isolable intermediates are to be included in schemes and will get put into a separate reaction database for reaction searching.
  2. Elusive intermediates and transition states can also be put into schemes but they will not be included in the reaction database. They should be placed within square brackets.

Scheme 1 shows an illustrative example of a reaction scheme.

**Scheme 1** Synthesis and Reaction of a Dienyl Sulfone<sup>[8,9]</sup>



For drawings prepared by CSC ChemDraw, use the following settings, printed at 100% (page setup = 100%).

Choose settings type:	Science of Synthesis, except for the margin width
Font for atoms labels:	10 point Arial
Font for reaction conditions, yields, etc.:	8 point Arial
Font for compound numbers:	10 point Arial bold
Chain angle:	120 degrees
Bond spacing:	18% of length
Fixed length:	17 point (0.600 cm, 0.236")
Bond width:	2.0 point (0.071 cm, 0.027")
Line width:	0.8 point (0.028 cm, 0.011")
Margin width:	2.2 point (0.079 cm, 0.031")
Hash spacing:	2.5 point (0.088 cm, 0.035")

Science of Synthesis document settings can be selected automatically in recent versions of ChemDraw.

### 3.7 Guidelines for Figures

Figures should be numbered with Arabic numerals. When referring for the first time to information given in a figure, please quote the figure number in brackets. Figure captions will not be listed at the end of the manuscript and will instead stay in the manuscript. A figure should be indicated in the text in the following way:

<Figure 1> This is a Sample Figure<sup>[23]</sup>

Figures should be placed separately in Part 5 of your manuscript. They must **not** be electronically embedded in the text.

If necessary, figures will be redrawn by the publishers. For checking and correction, the redrawn figures will be sent back to the author. In the case of figures taken from existing publications, it is the legal responsibility of the author to obtain permission for reproduction from the copyright holder, although the Editorial Office can offer assistance with such matters; this should be done at a very early stage of the book production. For figures of apparatus, please directly contact the apparatus producer company. If figures are not produced by the author, the copyright of the figure must be included in the caption. Submit only original figures or high-quality photographic prints of originals. For the

preparation of graphs, authors are requested to follow the suggestions of H. G. Hers [*Nature*, (1984) 307, 205].

### 3.8 Delivery of the Manuscripts

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Authors are requested to send a copy of their table of contents to the Editorial Office and to the volume editor by e-mail ([science-of-synthesis@thieme.de](mailto:science-of-synthesis@thieme.de)). Authors will then receive a revised table of contents with comments and suggestions from the volume editor and/or the Editorial Office.

#### 3.8.2 Submission of Final Manuscript

Please send a copy of your completed manuscript to the volume editor, who will advise on revision if necessary. The **final** version of the revised manuscript has to be sent to the Editorial Office by e-mail ([science-of-synthesis@thieme.de](mailto:science-of-synthesis@thieme.de)) by the agreed deadline.

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The manuscript submitted to the Editorial Office will then be assigned to a copy editor who will copyedit the manuscript and apply the necessary styles for *Water in Organic Synthesis*, e.g. check nomenclature, grammar, syntax, punctuation, phrasing, redundancy of text, and the like. Copy editors will correspond directly with authors regarding any queries and try to resolve them before proceeding to the page proof stage. It is inevitable that corrections will still need to be made to the page proofs, but each copy editor will aim to eliminate as many errors as possible prior to this stage by editing the manuscript thoroughly. The Editorial Office will then use the manuscripts for the production of the electronic version and prepare them for typesetting.

#### 3.8.4 Page Proofs

At this stage, page proofs will be sent to the author and volume editor for correction. The correction of page proofs should be limited to the correction of printing errors or other mistakes and should not involve major changes to the text. If more extensive corrections are necessary as a result of significant new developments, the volume editor should be consulted. Please note that the symbols ■■■ indicate that something was missing or unclear in the manuscript and the pertinent information should be added during correction. The page proofs should be returned to the Editorial Office by the deadline given. The author's and volume editor's responsibilities end with the correction of the page proofs. The author and volume editor then sign the page proofs as a permission to publish the manuscript (*Imprimatur*). By accepting a manuscript the publisher acquires all rights, in particular copyright and the right of translation. The proof sheets are not indicative of the quality of the final print.

The page layout of the contribution follows the proof correction, i.e. the text is laid out to the exact page length, the pages are numbered, and tables, schemes, and figures are placed as near as possible to the positions indicated by the author and volume editor in the page proofs.

### 3.9 Use of the Document Template

Authors will be able to download style templates for their word-processing programs from the *Science of Synthesis* Web site ([www.science-of-synthesis.com](http://www.science-of-synthesis.com)).

The *Science of Synthesis* document template contains a list of formatting styles that have to be applied to the chapter captions of your manuscript. The file is called **scisynth.dot**. However, the manuscript will not have the same print format as shown in the sample chapter. The sample chapter as it appears by using the template can also be found online: **elecsamp.doc**. This file is intended to illustrate how the template should be used. It also shows that at this stage manuscripts do **not** have the same format as in print.

### 3.10 Frequently Asked Questions

**Q: Does the document template have to be used?**

**A:** It is important for the development of the electronic version that the appropriate style name (e.g., H\_Method) is attached to the heading paragraphs for each section. It is not important that formatting properties such as font size, line spacing, or the number of lines per page match the document template. Please feel free to change these properties as long as the style naming is not reflected. Apart from style names all formatting options will be deleted by the document processing program. The document template is designed to make formatting the manuscript easier for the user in that the appropriate style can be chosen quickly from the menu.

**Q: I have never used a template before and am not sure where to start.**

**A:** There is a Readme file provided with the document template. It is advisable that you print this out and read it first.

**Q: I don't know where to save the template file (scisynth.dot).**

**A:** It is difficult to state categorically where individual users save their template files. On a PC, on which the whole Microsoft Office software package is installed, it is normally in the directory C:\MSOffice\Template. With only the Microsoft Word processor installed you will find the directory under C:\MSWord\Template. For the Macintosh it strongly depends on the version of Word used. Newer Macintosh Word versions have the same menu items as the Windows Word versions. The folder where the document templates are stored can be detected in Word in "Tools|Templates and Add-Ins". If in doubt, please refer to the in-house computer specialist for advice.

**Q: Is it acceptable to adjust the font size and spacing?**

**A:** The font type and style of the text is important for its identification. Font size and spacing is not important.

**Q: How should I handle tables?**

**A:** Tables should be composed using the table set-up tools of the word processing program. Tables should be placed in the appropriate position in the body of the text. The tables in the text should be labeled clearly with a caption, e.g. <Table 1> Table Caption (Times).

**Q: How should I handle drawings in tables?**

**A:** State the file name of the drawing (handwritten) in the required position in the table on the hardcopy of the manuscript. Store the drawing as a separate file using the formula name as the file name.

**Q: Is it possible to handle several schemes in one file?**

A: No. Each scheme should be saved in a separate file as should any figures using the scheme or figure number as the file name e.g. scheme1.cdx.

**Q: What word processing program should I be using?**

A: The following word processing programs are preferred:

- Microsoft Word 2000
- Microsoft Word 2002
- Microsoft Word 2003
- Microsoft Word 2007 (but please save the document in .doc format)
- Microsoft Word for Macintosh 6.0 or higher

The document template is currently available for all of these packages. For other word processors please contact the Editorial Office and discuss your requirements. However the use of LATEX should be avoided.

**Q: What structure drawing program should I be using?**

A: Please generate your schemes using ChemDraw (preferably the latest version both for Microsoft Windows or for Macintosh) or using ISIS/Draw.

**Q: What are the page extent rules for manuscript submission?**

A: The volume editor and authors are requested to be aware of the contracted page extent as outlined in the Contributing Author's Agreement, and to not exceed the given number of printed pages for each volume. For estimating the final length of a contribution, the following general rules should be used:

1 typewritten page = 24 lines of characters

1 printed page = 3 typewritten pages (*no* schemes/tables)  
= 2 typewritten pages (*with* schemes/tables)

**Q: Do I need to use any particular units or abbreviations?**

A: Metric units should be used throughout the text. However, for pressure and temperature, Torr/atm/Pa and °C can be used, respectively. The unit kcal is also accepted. The use of abbreviations is recommended in schemes, tables, and experimental procedures, but not in titles or text. Please see the Appendix for a full list of abbreviations.

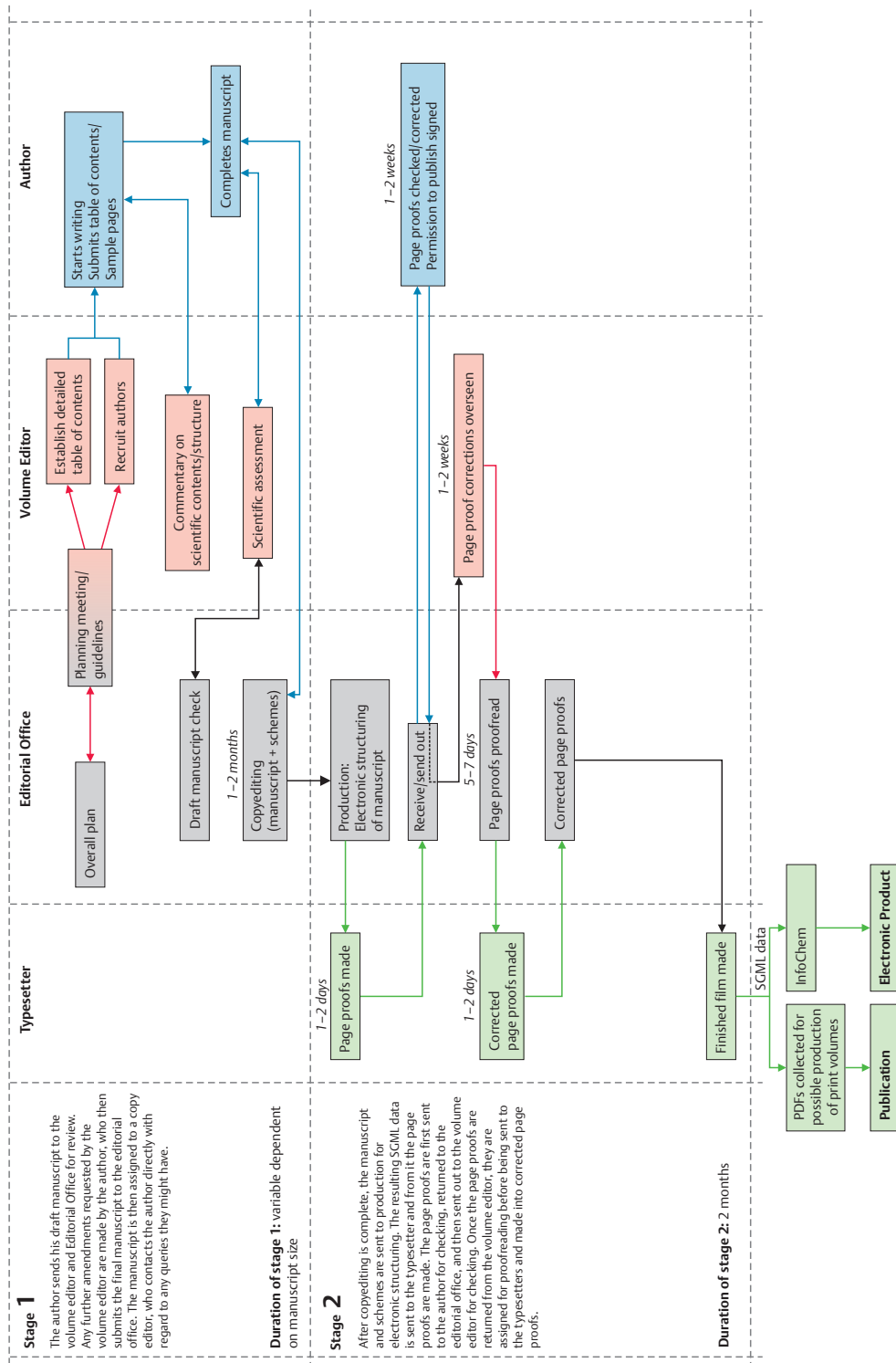
**Q: What do the symbols ■■■ in the page proofs mean?**

A: The symbols indicate that something is missing or unclear in the manuscript and the author should add the missing information during correction.

**Q: What is the difference between a General Procedure and a Typical Procedure?**

A: A General Procedure is a generalized version of a widely applicable experimental procedure. A Typical Procedure is a specific example of a widely applicable experimental procedure.

## Workflow Chart for Water in Organic Synthesis



## 4 Appendix

## 4.1 Chemical and General Abbreviations Used in Water in Organic Synthesis

## Chemical

Name Used in Text	Abbreviation Used in Tables and on Arrow in Schemes	Abbreviation Used in Experimental Procedures
( <i>R</i> )-1-amino-2-(methoxymethyl)pyrrolidine	RAMP	RAMP
( <i>S</i> )-1-amino-2-(methoxymethyl)pyrrolidine	SAMP	SAMP
ammonium cerium(IV) nitrate	CAN	CAN
2,2'-azobisisobutyronitrile	AIBN	AIBN
barbituric acid	BBA	BBA
benzyltriethylammonium bromide	TEBAB	TEBAB
benzyltriethylammonium chloride	TEBAC	TEBAC
<i>N,O</i> -bis(trimethylsilyl)acetamide	BSA	BSA
9-borabicyclo[3.3.1]nonane	9-BBNH	9-BBNH
borane–dimethyl sulfide complex	BMS	BMS
<i>N</i> -bromosuccinimide	NBS	NBS
<i>tert</i> -butyldimethylsilyl chloride	TBDMSCI	TBDMSCI
<i>tert</i> -butyl peroxybenzoate	TBPB	<i>tert</i> -butyl peroxybenzoate
10-camphorsulfonic acid	CSA	CSA
chlorosulfonyl isocyanate	CSI	chlorosulfonyl isocyanate
3-chloroperoxybenzoic acid	MCPBA	MCPBA
<i>N</i> -chlorosuccinimide	NCS	NCS
chlorotrimethylsilane	TMSCI	TMSCI
1,4-diazabicyclo[2.2.2]octane	DABCO	DABCO
1,5-diazabicyclo[4.3.0]non-5-ene	DBN	DBN
1,8-diazabicyclo[5.4.0]undec-7-ene	DBU	DBU
dibenzoyl peroxide	DBPO	dibenzoyl peroxide
dibenzylideneacetone	dba	dba
di- <i>tert</i> -butyl azodicarboxylate	DBAD	di- <i>tert</i> -butyl azo-dicarboxylate
2,3-dichloro-5,6-dicyanobenzo-1,4-quinone	DDQ	DDQ
dichloromethyl methyl ether	DCME	DCME
dicyclohexylcarbodiimide	DCC	DCC
<i>N,N</i> -diethylaminosulfur trifluoride	DAST	DAST
diethyl azodicarboxylate	DEAD	DEAD
diethyl tartrate	DET	DET
2,2'-dihydroxy-1,1'-binaphthyllithium aluminum hydride	BINAL-H	BINAL-H
diisobutylaluminum hydride	DIIBAL-H	DIBAL-H
diisopropyl tartrate	DIPT	DIPT
1,2-dimethoxyethane	DME	DME

**Chemical** (cont.)

Name Used in Text	Abbreviation Used in Tables and on Arrow in Schemes	Abbreviation Used in Experimental Procedures
dimethylacetamide	DMA	DMA
dimethyl acetylenedicarboxylate	DMAD	DMAD
2-(dimethylamino)ethanol	Me <sub>2</sub> N(CH <sub>2</sub> ) <sub>2</sub> OH	2-(dimethylamino)ethanol
4-(dimethylamino)pyridine	DMAP	DMAP
dimethylformamide	DMF	DMF
dimethyl sulfide	DMS	DMS
dimethyl sulfoxide	DMSO	DMSO
di- <i>tert</i> -butyl peroxide	DTBP	DTBP
1,3-dimethyl-3,4,5,6-tetrahydro-pyrimidin-2(1 <i>H</i> )-one	DMPU	DMPU
ethyl diazoacetate	EDA	EDA
ethylenediaminetetraacetic acid	edta	edta
hexamethylphosphoric triamide	HMPA	HMPA
hexamethylphosphorous triamide	HMPT	HMPT
iodomethane	MeI	MeI
<i>N</i> -iodosuccinimide	NIS	NIS
lithium diisopropylamide	LDA	LDA
lithium hexamethyldisilazane	LiHMDS	LiHMDS
lithium isopropylcyclohexylamide	LICA	LICA
lithium 2,2,6,6-tetramethylpiperidide	LTMP	LTMP
lutidine	lut	lut
methylaluminum bis(2,6-di- <i>tert</i> -butyl-4-methylphenoxide)	MAD	MAD
methyl ethyl ketone	MEK	methyl ethyl ketone
<i>N</i> -methylmaleimide	NMM	NMM
4-methylmorpholine <i>N</i> -oxide	NMO	NMO
1-methylpyrrolidin-2-one	NMP	NMP
methyl vinyl ketone	MVK	methyl vinyl ketone
petroleum ether	PE <sup>a</sup>	petroleum ether
<i>N</i> -phenylmaleimide	NPM	NPM
polyphosphoric acid	PPA	PPA
polyphosphate ester	PPE	polyphosphate ester
potassium hexamethyldisilazane	KHMDS	KHMDS
pyridine	pyridine <sup>b</sup>	pyridine
pyridinium chlorochromate	PCC	PCC
pyridinium dichromate	PDC	PDC
pyridinium 4-toluenesulfonate	PPTS	PPTS
sodium bis(2-methoxyethoxy)aluminum hydride	Red-Al	Red-Al
tetrabutylammonium bromide	TBAB	TBAB

<sup>a</sup> Used to save space; abbreviation must be defined in a footnote.<sup>b</sup> py used on arrow in schemes.

**Chemical** (cont.)

Name Used in Text	Abbreviation Used in Tables and on Arrow in Schemes	Abbreviation Used in Experimental Procedures
tetrabutylammonium chloride	TBACl	TBACl
tetrabutylammonium fluoride	TBAF	TBAF
tetrabutylammonium iodide	TBAI	TBAI
tetracyanoethene	TCNE	tetracyanoethene
tetrahydrofuran	THF	THF
tetrahydropyran	THP	THP
2,2,6,6-tetramethylpiperidine	TMP	TMP
trimethylamine <i>N</i> -oxide	TMANO	trimethylamine <i>N</i> -oxide
<i>N,N,N',N'</i> -tetramethylethylenediamine	TMEDA	TMEDA
tosylmethyl isocyanide	TosMIC	TosMIC
trifluoroacetic acid	TFA	TFA
trifluoroacetic anhydride	TFAA	TFAA
trimethylsilyl cyanide	TMSCN	TMSCN

**Ligands**

acetylacetonato	acac
2,2'-bipyridyl	bipy
1,2-bis(dimethylphosphino)ethane	DMPE
2,3-bis(diphenylphosphino)bicyclo[2.2.1]hept-5-ene	NORPHOS
2,2'-bis(diphenylphosphino)-1,1'-binaphthyl	BINAP
1,2-bis(diphenylphosphino)ethane	dppe (not diphos)
1,1'-bis(diphenylphosphino)ferrocene	dppf
bis(diphenylphosphino)methane	dppm
1,3-bis(diphenylphosphino)propane	dppp
1,4-bis(diphenylphosphino)butane	dppb
2,3-bis(diphenylphosphino)butane	Chiraphos
bis(salicylidene)ethylenediamine	salen
cyclooctadiene	cod
cyclooctatetraene	cot
cyclooctatriene	cte
$\eta^5$ -cyclopentadienyl	Cp
dibenzylideneacetone	dba
6,6-dimethylcyclohexadienyl	dmch
2,4-dimethylpentadienyl	dmpd
ethylenediaminetetraacetic acid	edta
isopinocampheyl	lpc
2,3- <i>O</i> -isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphino)butane	Diop
norbornadiene (bicyclo[2.2.1]hepta-2,5-diene)	nbd
$\eta^5$ -pentamethylcyclopentadienyl	Cp*

**Radicals**

acetyl	Ac
aryl	Ar
benzotriazol-1-yl	Bt
benzoyl	Bz
benzyl	Bn
benzyloxycarbonyl	Cbz
benzyloxymethyl	BOM
9-borabicyclo[3.3.1]nonyl	9-BBN
<i>tert</i> -butoxycarbonyl	Boc
butyl	Bu
<i>sec</i> -butyl	<i>s</i> -Bu
<i>tert</i> -butyl	<i>t</i> -Bu
<i>tert</i> -butyldimethylsilyl	TBDMS
<i>tert</i> -butyldiphenylsilyl	TBDPS
cyclohexyl	Cy
3,4-dimethoxybenzyl	DMB
ethyl	Et
ferrocenyl	Fc
9-fluorenylmethoxycarbonyl	Fmoc
isobutyl	iBu
mesityl	Mes
mesyl	Ms
4-methoxybenzyl	PMB
(2-methoxyethoxy)methyl	MEM
methoxymethyl	MOM
methyl	Me
4-nitrobenzyl	PNB
phenyl	Ph
phthaloyl	Phth
phthalimido	NPhth
propyl	Pr
isopropyl	iPr
tetrahydropyranyl	THP
tolyl	Tol
tosyl	Ts
triethylsilyl	TES
triflyl, trifluoromethanesulfonyl	Tf
triisopropylsilyl	TIPS
trimethylsilyl	TMS
2-(trimethylsilyl)ethoxymethyl	SEM
trityl [triphenylmethyl]	Tr

**General**

absolute	abs
anhydrous	anhyd
aqueous	aq
boiling point	bp
catalyst	no abbreviation
catalytic	cat.
chemical shift	$\delta$
circular dichroism	CD
column chromatography	no abbreviation
concentrated	concd
configuration (in tables)	Config
coupling constant	<i>J</i>
day	d
density	<i>d</i>
decomposed	dec
degrees Celsius	°C
diastereomeric ratio	dr
dilute	dil
electron-donating group	EDG
electron-withdrawing group	EWG
electrophile	E <sup>+</sup>
enantiomeric excess	ee
enantiomeric ratio	er
equation	eq
equivalent(s)	equiv
flash-vacuum pyrolysis	FVP
gas chromatography	GC
gas chromatography–mass spectrometry	GC/MS
gas–liquid chromatography	GLC
gram	g
highest occupied molecular orbital	HOMO
high-performance liquid chromatography	HPLC
hour(s)	h
infrared	IR
in situ	in situ
in vacuo	in vacuo
lethal dosage, e.g. to 50% of animals tested	LD <sub>50</sub>
liquid	liq
liter	L
lowest unoccupied molecular orbital	LUMO
mass spectrometry	MS
medium-pressure liquid chromatography	MPLC
melting point	mp
milliliter	mL
millimole(s)	mmol
millimoles per liter	mM
minute(s)	min
mole(s)	mol
nuclear magnetic resonance	NMR
nucleophile	Nu <sup>-</sup>
optical purity	op
phase-transfer catalysis	PTC
proton NMR	<sup>1</sup> H NMR

**General** (cont.)

quantitative	quant
reference (in tables)	Ref
retention factor (for TLC)	$R_f$
retention time (chromatography)	$t_R$
room temperature	rt
saturated	sat.
solution	soln
temperature (in tables)	Temp (°C)
thin layer chromatography	TLC
ultraviolet	UV
volume (literature)	Vol.
via	via
vide infra	<i>vide infra</i>
vide supra	<i>vide supra</i>
yield (in tables)	Yield (%)

## 4.2 Journal Abbreviations

- Acc. Chem. Res.  
 Acta Biochim. Pol.  
 Acta Chem. Scand.  
 Acta Chem. Scand., Ser. A  
 Acta Chem. Scand., Ser. B  
 Acta Chim. Acad. Sci. Hung.  
 Acta Chim. Hung.  
 Acta Chim. Sin. (Engl. Ed.)  
 Acta Chim. Slov.  
 Acta Crystallogr.  
 Acta Crystallogr., Sect. A  
 Acta Crystallogr., Sect. B  
 Acta Crystallogr., Sect. C  
 Acta Pharm. Hung.  
 Acta Pharm. Jugosl.  
 Acta Pharm. Nord.  
 Acta Pharm. Suec.  
 Acta Pharm. Turc.  
 Acta Pol. Pharm.  
 Acta Univ. Palack. Olomuc.  
 Actual. Chim.  
 Actual. Chim. Ther.  
 Adv. Carbohydr. Chem.  
 Adv. Carbohydr. Chem. Biochem.  
 Adv. Catal.  
 Adv. Chem. Ser.  
 Adv. Cyloaddit.  
 Adv. Drug Res.  
 Adv. Exp. Med. Biol.  
 Adv. Free-Radical Chem. (London)  
 Adv. Heterocycl. Chem.  
 Adv. Heterocycl. Chem., Suppl. 1  
 Adv. Heterocycl. Chem., Suppl. 2  
 Adv. Inorg. Chem. Radiochem.  
 Adv. Mater. (Weinheim, Ger.)  
 Adv. Met.-Org. Chem.  
 Adv. Mol. Struct. Res.  
 Adv. Nitrogen Heterocycl.  
 Adv. Org. Chem.  
 Adv. Organomet. Chem.  
 Adv. Polym. Sci.  
 Adv. Prostaglandin, Thromboxane,  
 Leukotriene Res.  
 Adv. Protein Chem.  
 Adv. Silicon Chem.  
 Adv. Strain Org. Chem.  
 Adv. Strained Interesting Org. Mol.  
 Adv. Synth. Catal.  
 Adv. Ther.  
 Adv. Urethane Sci. Technol.  
 Aerosol Sci. Technol.  
 Afmidad  
 Agents Actions  
 Agra Univ. J. Res., Sci.  
 Agric. Biol. Chem.  
 Agrokem. Talajtan  
 Aldrichimica Acta  
 Alexandria J. Pharm. Sci.  
 Am. Chem. J.  
 Am. Heart J.  
 Am. J. Bot.  
 Am. J. Hypertens.  
 Am. J. Physiol.  
 Amino Acids  
 An. Asoc. Quim. Argent.  
 An. Fis. Quim.
- An. Quim.  
 An. Quim. Int. Ed.  
 An. Quim., Ser. C  
 An. R. Acad. Farm.  
 An. R. Soc. Esp. Fis. Quim., Ser. B  
 An. Stiint. Univ. "Al. I. Cuza" Iasi,  
 Sect. 1c  
 An. Univ. Bucuresti, Ser. Stiint. Nat.  
 Anal. Biochem.  
 Anal. Chem.  
 Anal. Chim. Acta  
 Anal. Sci.  
 Analyst  
 Angew. Chem.  
 Angew. Chem. Int. Ed.  
 Angew. Chem. Int. Ed. Engl.  
 Angew. Chem. Suppl.  
 Angew. Makromol. Chem.  
 Ann. Chim. (Paris)  
 Ann. Chim. (Rome)  
 Ann. Chim. Phys.  
 Ann. N.Y. Acad. Sci.  
 Ann. Pharm. (Lemgo, Ger.)  
 Ann. Pharm. Fr.  
 Ann. Phys. (Paris)  
 Ann. Univ. Mariae Curie-Sklodowska,  
 Sect. AA: Chem.  
 Annu. Rep. NMR Spectrosc.  
 Annu. Rep. Sankyo Res. Lab.  
 Annu. Rev. Biochem.  
 Annu. Rev. Biophys. Biomol. Struct.  
 Annu. Rev. Mater. Sci.  
 Antibiot. Annu.  
 Antibiot. Chemother.  
 (Washington, D. C.)  
 Anti-Cancer Drug Des.  
 Anti-Cancer Drugs  
 Anticancer Res.  
 Antimicrob. Agents Chemother.  
 Antiviral Chem. Chemother.  
 Appl. Catal., A  
 Appl. Fluoresc. Technol.  
 Appl. Geochem.  
 Appl. Microbiol. Biotechnol.  
 Appl. Organomet. Chem.  
 Appl. Phys. A  
 Appl. Phys. B  
 Appl. Phys. Lett.  
 Aquat. Toxicol.  
 Arch. Biochem. Biophys.  
 Arch. Gesamte Virusforsch.  
 Arch. Med. Res.  
 Arch. Microbiol.  
 Arch. Pharm. (Weinheim, Ger.)  
 Arch. Pharm. Ber. Dtsch. Pharm. Ges.  
 Arch. Pharmacol. Res.  
 Ark. Kemi  
 ARKIVOC  
 Arm. Khim. Zh.  
 Arzneimittel-Forsch.  
 Asian J. Chem.  
 Asian J. Spectrosc.  
 Astrophys. J.  
 Aswan Sci. Technol. Bull.  
 Atti Accad. Naz. Lincei, Cl. Sci. Fis.,  
 Mat. Nat., Rend.
- Atti Accad. Sci., Lett. Arti Palermo,  
 Parte 1  
 Atti V. Congr. Naz. Chim. Pura Appl.  
 Sardinien  
 Aust. J. Chem.  
 Azerb. Khim. Zh.
- Barwniki, Srodki Pomocnicze  
 Basic Life Sci.  
 Beijing Huagong Daxue Xuebao  
 Beijing Yike Daxue Xuebao  
 Ber. Bunsen-Ges.  
 Ber. Dtsch. Chem. Ges.  
 Ber. Dtsch. Chem. Ges. A  
 Ber. Dtsch. Chem. Ges. B  
 Biocatalysis  
 Biochem. Biophys. Res. Commun.  
 Biochem. J.  
 Biochem. Pharmacol.  
 Biochem. Physiol. Pflanz.  
 Biochem. Prep.  
 Biochem. Soc. Trans.  
 Biochemistry  
 Biochim. Biophys. Acta  
 Bioconjugate Chem.  
 Biol. Akt. Soedin., Akad. Nauk SSSR  
 Biol. Met.  
 Biol. Pharm. Bull.  
 Biol. Trace Elem. Res.  
 BioMetals  
 Bioorg. Chem.  
 Bioorg. Khim.  
 Bioorg. Med. Chem.  
 Bioorg. Med. Chem. Lett.  
 Biopolymers  
 Biosci., Biotechnol., Biochem.  
 Biotechnol. Bioeng.  
 Biotechnol. Lett.  
 Biul. Inf.: Barwniki, Srodki Pomoc-  
 nicze  
 Boll. Chim. Farm.  
 Boll. Sci. Fac. Chim. Ind. Bologna  
 Boll. Sedute Accad. Gioenia Sci. Nat.  
 Catania  
 Bone (N.Y.)  
 Br. J. Cancer  
 Br. J. Clin. Pharmacol.  
 Br. J. Pharmacol.  
 Brennst.-Chem. (1920–1969)  
 Bull. Acad. Pol. Sci., Ser. Sci. Chim.  
 Bull. Acad. R. Belg.  
 Bull. Acad. Sci. USSR, Div. Chem. Sci.  
 (Engl. Transl.)  
 Bull. Chem. Soc. Jpn.  
 Bull. Electrochem.  
 Bull. Fac. Pharm. (Cairo Univ.)  
 Bull. Fac. Sci., Assiut Univ.  
 Bull. Inst. Chem. Res., Kyoto Univ.  
 Bull. Korean Chem. Soc.  
 Bull. Pol. Acad. Sci., Chem.  
 Bull. Sci. (Cons. Acad. RSF Yougosl.)  
 Bull. Soc. Chim. Belg.  
 Bull. Soc. Chim. Biol.  
 Bull. Soc. Chim. Fr.  
 Bull. Soc. Chim. Romaniaia  
 Bull. Soc. R. Sci. Liege

- Bull. Univ. Osaka Prefect., Ser. A  
Burns
- C. R. (Dokl.) Acad. Sci. URSS  
C. R. Acad. Sci., Ser. IIB  
C. R. Hebd. Seances Acad. Sci.  
C. R. Seances Acad. Sci., Ser. 2  
C. R. Seances Acad. Sci., Ser. 3  
C. R. Seances Acad. Sci., Ser. C  
Calcif. Tissue Int.  
Can. J. Biochem.  
Can. J. Chem.  
Can. J. Chem. Eng.  
Can. J. Phys.  
Can. J. Spectrosc.  
Can. Med. Assoc. J.  
Cancer Chemother. Pharmacol.  
Cancer Invest.  
Cancer Lett.  
Cancer Res.  
Carbohydr. Res.  
Carcinogenesis  
Catal. Lett.  
Catal. Org. React.  
Catal. Rev.  
Catal. Today  
Cell Biochem. Biophys.  
Cell. Mol. Biol. (Paris)  
Cell. Signalling  
Cesko-Slov. Farm.  
Chem. Abstr.  
Chem. Anal. (Warsaw)  
Chem. Ber.  
Chem. Ber./Recl.  
Chem. Biol.  
Chem. Br.  
Chem. Chron. A  
Chem. Commun.  
Chem. Commun. (Cambridge)  
Chem. Eng. Commun.  
Chem. Eng. News  
Chem. Eng. Sci.  
Chem. Express  
Chem. Heterocycl. Compd. (Engl. Transl.)  
Chem. Ind. (London)  
Chem. Lett.  
Chem. Listy  
Chem. Mater.  
Chem. News  
Chem. Org. Sulfur Compd.  
Chem. Pap.  
Chem. Pharm. Bull.  
Chem. Phys.  
Chem. Phys. Lett.  
Chem. Phys. Lipids  
Chem. Prum.  
Chem. Res. Toxicol.  
Chem. Rev.  
Chem. Scr.  
Chem. Soc. Rev.  
Chem. Stosow., Ser. A  
Chem. Technol.  
Chem. Unserer Zeit  
Chem. Weekbl.  
Chem. Zentralbl.  
Chem. Zvesti  
Chem.-Biol. Interact.  
Chem.-Eur. J.  
Chem.-Ing.-Tech.
- Chem.-Ztg.  
ChemBioChem  
Chemical Industries (Dekker)  
Chemistry & Biodiversity  
Chemistry (Rajkot, India)  
Chemosphere  
Chemother. J.  
Chemotherapy (Basel)  
Chemtracts  
Chemtracts: Org. Chem.  
Chemtronics  
Chim. Acta Turc.  
Chim. Chron.  
Chim. Ind. (Milan)  
Chim. Oggi  
Chim. Ther.  
Chimia  
Chin. Chem. Lett.  
Chin. J. Chem.  
Chirality  
Chromatography  
Circ.-Calif. Agric. Exp. Stn.  
Clin. Cancer Res.  
Clin. Colorectal Cancer  
Clin. Exp. Allergy  
Clin. Pharmacol. Ther.  
Clin. Res.  
CNS Drugs  
Cold Spring Harbor Symp. Quant. Biol.  
Collect. Czech. Chem. Commun.  
Comb. Chem. High Throughput Screening  
Combust. Flame  
Comments Inorg. Chem.  
Commun. Fac. Sci. Univ. Ankara, Ser. B: Chem. Chem. Eng.  
Contemp. Org. Synth.  
Coord. Chem. Rev.  
Corsi Semin. Chim.  
Croat. Chem. Acta  
Cryst. Eng.  
Cryst. Struct. Commun.  
Curr. Med. Chem.  
Curr. Med. Chem.: Anti-Cancer Agents  
Curr. Opin. Oncol. Endocr. Metab. Invest. Drugs  
Curr. Org. Chem.  
Curr. Pharm. Des.  
Curr. Probl. Epilepsy  
Curr. Sci.  
Curr. Ther. Res.  
Curr. Top. Phytochem.
- Dalian Ligong Daxue Xuebao  
Dalton Trans.  
Dangerous Prop. Ind. Mater. Rep.  
Daxue Huaxue  
Delta J. Sci.  
Diagn. Microbiol. Infect. Dis.  
Diss. Abstr.  
Diss. Abstr. Int., B  
Diss. Pharm.  
Doga Bilim Derg., Seri A1  
Dokl. Akad. Nauk  
Dokl. Akad. Nauk Belarusi  
Dokl. Akad. Nauk BSSR  
Dokl. Akad. Nauk Resp. Uzb.  
Dokl. Akad. Nauk SSSR  
Dokl. Akad. Nauk Ukr. SSR, Ser. B: Geol., Khim. Biol. Nauki
- Dokl. Akad. Nauk UzSSR  
Dokl. Bolg. Akad. Nauk  
Dokl. Chem. (Engl. Transl.)  
Dokl. Vses. Konf. Khim. Atsetilena, 4th  
Dokl.-Akad. Nauk Az. SSR  
Dopov. Akad. Nauk Ukr. RSR, Ser. B: Geol., Khim. Biol. Nauki  
Drug Des. Discovery  
Drug Dev. Res.  
Drug Metab. Dispos.  
Drugs  
Drugs Exp. Clin. Res.  
Drugs Future  
Dtsch. Apoth. Ztg.  
Dyes Pigm.
- Egypt. J. Chem.  
Egypt. J. Pharm. Sci.  
Eisei Shikensho Hokoku  
Electrochem. Commun.  
Electrochim. Acta  
Enantiomer  
Elektrokimiya  
Enantiomer  
Encycl. Polym. Sci. Technol.  
Endocr. Res.  
Energy Fuels  
Environ. Health Perspect.  
Environ. Sci. Technol.  
Environ. Toxicol. Chem.  
Epilepsia  
Eur. J. Cancer  
Eur. J. Cell Biol.  
Eur. J. Inorg. Chem.  
Eur. J. Med. Chem.  
Eur. J. Neurosci.  
Eur. J. Org. Chem.  
Eur. J. Pharmacol.  
Eur. J. Phycol.  
Eur. J. Solid State Inorg. Chem.  
Eur. Polym. J.  
Eur. Urol.  
Exp. Parasitol.  
Experientia  
Expert Opin. Pharmacother.  
Explosion
- Faraday Discuss. Chem. Soc.  
Farbe + Lack  
Farm. Nueva  
Farmaco  
Farmaco, Ed. Sci.  
Farmatsiya (Sofia)  
FEBS Lett.  
FEMS Microbiol. Lett.  
Fette, Seifen, Anstrichm.  
Fiziol. Aktiv. Veshchestva, Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb.  
Food Chem.  
Food Chem. Toxicol.  
Food Sci. Technol. (London)  
Forensic Sci. Soc.  
Fortschr. Chem. Forsch.  
Fortschr. Chem. Org. Naturst.  
Free Radical Biol. Med.  
Fresenius' Z. Anal. Chem.  
Fuel  
Fukui Daigaku Kokagaku Kenkyu Hokoku

- Gaodeng Xuexiao Huaxue Xuebao  
 Gazz. Chim. Ital.  
 Genetika (Moscow)  
 Gifu Yakka Daigaku Kiyō  
 Glas. Hem. Drus. Beograd  
 Green Chem.  
 Guangpu Shiyanshi  
 Guangzhou Huagong  
  
 Hacettepe Bull. Nat. Sci. Eng.  
 Handb. Exp. Pharmacol.  
 Han'guk Susan Hakhoechi  
 Helv. Chim. Acta  
 Herba Pol.  
 Heteroat. Chem.  
 Heterocycl. Chem.  
 Heterocycl. Commun.  
 Heterocycles  
 High Perform. Polym.  
 Hoppe-Seyler's Z. Physiol. Chem.  
 Horm. Metab. Res.  
 Huagong Jinzhan  
 Huaxue Shiji  
 Huaxue Xuebao  
 Hukusokan Kagaku Toronkai Koen  
 Yoshishu 8th  
 Hum. Gene Ther.  
 Hum. Reprod.  
 Hunan Daxue Xuebao, Ziran Kexue-  
 ban  
 Hung. J. Ind. Chem.  
 Hydrocarbon Process. Pet. Refin.  
  
 IARC Sci. Publ.  
 Igong Nonjip  
 Ind. Chem. Libr.  
 Ind. Chim. Belge  
 Ind. Eng. Chem.  
 Ind. Eng. Chem. Prod. Res. Dev.  
 Ind. Eng. Chem. Res.  
 Indian J. Appl. Chem.  
 Indian J. Chem.  
 Indian J. Chem., Sect. A  
 Indian J. Chem., Sect. B  
 Indian J. Exp. Biol.  
 Indian J. Fibre Text. Res.  
 Indian J. Heterocycl. Chem.  
 Indian J. Nat. Prod.  
 Indian J. Pharm.  
 Indian J. Pharm. Sci.  
 Inf. Chim.  
 Inorg. Chem.  
 Inorg. Chem. Commun.  
 Inorg. Chim. Acta  
 Inorg. Chim. Acta, Rev.  
 Inorg. Nucl. Chem. Lett.  
 Inorg. Synth.  
 Int. J. Biochem.  
 Int. J. Chem. Kinet.  
 Int. J. Environ. Anal. Chem.  
 Int. J. Mass Spectrom. Ion Phys.  
 Int. J. Miner. Process.  
 Int. J. Mol. Med.  
 Int. J. Pept. Protein Res.  
 Int. J. Protein Res.  
 Int. J. Quantum Chem.  
 Int. J. Sulfur Chem.  
 Int. J. Sulfur Chem., Part A  
 Int. J. Sulfur Chem., Part B  
 Int. Prog. Urethanes  
  
 Int. Symp. Organosilicon Chem.,  
 Sci. Commun. 1965  
 Internet J. Chem.  
 Intra-Sci. Chem. Rep.  
 Invest. New Drugs  
 Iran J. Chem. Chem. Eng.  
 Isotopenpraxis  
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 Izv. Sekt. Platiny Drugikh Blagorodn.  
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 Izv. Sib. Otd. Akad. Nauk SSSR, Ser.  
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