



The Writing Center

UNIVERSITY OF COLORADO
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American Chemical Society (ACS) Citation Guidelines, 3rd Edition

The American Chemical Society (ACS) is an American-based scientific organization founded in 1876 at New York University that focuses on the field of chemistry. The group is recognized by the U.S. government through a congressional charter and is the largest scientific society by membership. ACS produces more than 60 scholarly journals, including the prestigious *Journal of the American Chemical Society*. The current citation guidebook is *ACS Style Guide: Effective Communication of Scientific Information, 3rd Edition*, edited by Anne M. Coghil and Lorrin R. Garson.

In-Text Citations

ACS offers three approaches to cite sources in-text: **Superscript**, **Italic Numbers in Parentheses**, and **Author-Date**. When writing your paper, choose one of these in-text citation styles and use it consistently.

Superscript and **Italic Numbers in Parentheses** are the generally preferred methods because they distract less from the content of the paper and consume less space on the page. Sources are numbered by order of appearance in the text. The first source cited would be ¹ or (1), the second source cited would be ² or (2), etc. If a source is cited more than once, use the first number assigned to it, so the second and subsequent references to this citation will always appear as ² or (2).

Superscript	
Following reference to single-author work:	Brown ⁵ discovered the synthetic power of hydroboration.
Following reference to two-author work:	Chen and Brandizzi ⁷ summarize the effects of the IRE1 on cell vitality.
Following reference to three-or-more-author work.	Lassig et al. ³ made multiple mutations of the protein.
End of sentence	The drug, 4 μ 8C, inhibits activation of the pathway. ¹⁴

Italics in Parentheses	
Following reference to single-author work	Brown (5) discovered the synthetic power of hydroboration.
Following reference to two-author work	Chen and Brandizzi (7) summarize the effects of the IRE1 on cell vitality.

Following reference to three-or-more-author work.	Lassig et al. (3) made multiple mutations of the protein.
End of sentence	The drug, 4 μ 8C, inhibits activation of the pathway. (14)

Author-Date is used when the year the article was published is important, such as in a literature review; however, this style of ACS citation is not commonly used.

Author-Date	
Following reference to single-author work	Brown (1961) discovered the synthetic power of hydroboration.
End of sentence, one author	The discovery of hydroboration was necessary to further the field of synthetic chemistry (Brown, 1961).
Following reference to two author work	Chen and Brandizzi (2013) summarize the effects of the IRE1 on cell vitality.
End of sentence, two authors	IRE1 is an important pathway in cell vitality in regards to unfolded proteins (Chen and Brandizzi, 2013).
Following reference to three-or-more-author work	Lassig et al. (2015) made multiple mutations of the protein.
End of sentence, three or more authors	Multiple mutations were made of the protein (Lassig et al., 2015).

Works Cited

The *ACS Style Guide* does not have strict rules for collating works cited at the end of the text. Write and center either 'References' or 'Works Cited.' Make sure the references are differentiable from one another: For example, use a hanging indent (always recommended for **Author-Date**) or an indentation after the numeral (only recommended for **Superscript** and **Italics in Parenthesis**).

Hanging Indent:

Loudon, M.; Praise, J. Amino Acids, Peptides, and Proteins. In *Organic Chemistry*, Fein, J. S., Ed. W. H. Freeman and Company: New York, 2016; Vol. 6, pp 1373-1448.

OR

Indent after Assigned Numeral:

1. Loudon, M.; Praise, J. Amino Acids, Peptides, and Proteins. In *Organic Chemistry*, Fein, J. S., Ed. W. H. Freeman and Company: New York, 2016; Vol. 6, pp 1373-1448.

For **Superscript** and **Italics in Parenthesis**, references are organized by order of appearance. For example:

Hanging Indent:

References

1. Cross, B. C.; Bond, P. J.; Sadowski, P. G.; Jha, B. K.; Zak, J.; Goodman, J. M.; Silverman, R. H.; Neubert, T. A.; Baxendale, I. R.; Ron, D.; Harding, H. P. The

- Molecular Basis for Selective Inhibition of Unconventional mRNA Splicing by an IRE1-Binding Small Molecule. *Proc. Natl. Acad. Sci. U. S. A.* **2012**, *109* (15), E869-878.
2. Yoshida, H.; Matsui, T.; Yamamoto, A.; Okada, T.; Mori, K., XBP1 mRNA Is Induced by ATF6 and Spliced by IRE1 in Response to ER Stress to Produce a Highly Active Transcription Factor. *Cell* **2001**, *107* (7), 881-891.
 3. Bright, M. D.; Itzhak, D. N.; Wardell, C. P.; Morgan, G. J.; Davies, F. E. Cleavage of BLOC1S1 mRNA by IRE1 Is Sequence Specific, Temporally Separate from XBP1 Splicing, and Dispensable for Cell Viability Under Acute Endoplasmic Reticulum Stress. *Mol. Cell. Biol.* **2015**, *35* (12), 2186-2202.
 4. Tam, A. B.; Koong, A. C.; Niwa, M., IRE1 Has Distinct Catalytic Mechanisms for XBP1/HAC1 Splicing and RIDD. *Cell Rep.* **2014**, *9* (3), 850-858.

Indent After Assigned Numeral:

References

1. Cross, B. C.; Bond, P. J.; Sadowski, P. G.; Jha, B. K.; Zak, J.; Goodman, J. M.; Silverman, R. H.; Neubert, T. A.; Baxendale, I. R.; Ron, D.; Harding, H. P. The Molecular Basis for Selective Inhibition of Unconventional mRNA Splicing by an IRE1-Binding Small Molecule. *Proc. Natl. Acad. Sci. U. S. A.* **2012**, *109* (15), E869-878.
2. Yoshida, H.; Matsui, T.; Yamamoto, A.; Okada, T.; Mori, K. XBP1 mRNA Is Induced by ATF6 and Spliced by IRE1 in Response to ER Stress to Produce a Highly Active Transcription Factor. *Cell* **2001**, *107* (7), 881-891.
3. Bright, M. D.; Itzhak, D. N.; Wardell, C. P.; Morgan, G. J.; Davies, F. E. Cleavage of BLOC1S1 mRNA by IRE1 Is Sequence Specific, Temporally Separate from XBP1 Splicing, and Dispensable for Cell Viability Under Acute Endoplasmic Reticulum Stress. *Mol. Cell. Biol.* **2015**, *35* (12), 2186-2202.
4. Tam, A. B.; Koong, A. C.; Niwa, M. IRE1 Has Distinct Catalytic Mechanisms for XBP1/HAC1 Splicing and RIDD. *Cell Rep.* **2014**, *9* (3), 850-858.

For **Author-Date**, organize the references alphabetically by author. For example:

References

- Bright, M. D.; Itzhak, D. N.; Wardell, C. P.; Morgan, G. J.; Davies, F. E. Cleavage of BLOC1S1 mRNA by IRE1 Is Sequence Specific, Temporally Separate from XBP1 Splicing, and Dispensable for Cell Viability under Acute Endoplasmic Reticulum Stress. *Mol. Cell. Biol.* **2015**, *35* (12), 2186-2202.
- Cross, B. C.; Bond, P. J.; Sadowski, P. G.; Jha, B. K.; Zak, J.; Goodman, J. M.; Silverman, R. H.; Neubert, T. A.; Baxendale, I. R.; Ron, D.; Harding, H. P. The Molecular Basis for Selective Inhibition of Unconventional mRNA Splicing by an IRE1-Binding Small Molecule. *Proc. Natl. Acad. Sci. U. S. A.* **2012**, *109* (15), E869-878.
- Tam, A. B.; Koong, A. C.; Niwa, M., IRE1 Has Distinct Catalytic Mechanisms for XBP1/HAC1 Splicing and RIDD. *Cell Rep.* **2014**, *9* (3), 850-8.

Yoshida, H.; Matsui, T.; Yamamoto, A.; Okada, T.; Mori, K. XBP1 mRNA Is Induced by ATF6 and Spliced by IRE1 in Response to ER stress to Produce a Highly Active Transcription Factor. *Cell* **2001**, *107* (7), 881-891.

Same First Author, Multiple Sources

If the author of a paper is first author of multiple sources, list single-author works first, then two-author works, then multiple-author works. Within the groups of same-first-author works cited (e.g., single, dual, multiple), list the works chronologically. If the works cited were published the same year, add a lowercase letter for identification. For example:

Hamilton, F. J. *Biochemistry* **2003**, *42*, 78-86.
Hamilton F. J. *J. Agric. Food Chem.* **2004a**, *52*, 1622-1633.
Hamilton F. J. *J. Org Chem.* **2004b**, *69*, 298-306.
Hamilton, F. J.; Salvo, P. A. *J. Agric. Food Chem.* **2005**, *53*, 918-924.
Hurd, R. *J. Magn. Reson.* **1999**, *87*, 422.

CASSI Abbreviations:

The Chemical Abstract Service Source Index (CASSI) is a systematic way to abbreviate journal titles. Single-word titles (e.g., *Nature* and *Science*) are not abbreviated. CASSI abbreviations can be found here: <https://cassi.cas.org/search.jsp>

There are a few exceptions to the strict CASSI abbreviations. Periodicals with sections can be shortened further.

Strict CASSI:

Acta Crystallogr., Sect. C: Cryst. Struct. Commun. **2005**, *61*, 99-102.

Acceptable Variations:

Acta Crystallogr., Sect. C **2005**, *61*, 99-102.

Acta Crystallogr. **2005**, *C61*, 99-102.

Below are templates and examples for various types of sources. Many elements are optional: For example, if a work is accessed in print vs. online, do not include the URL. Include all available information easily accessible from the source, but do not worry if that does not include everything listed in the template. If the source does not include one of the elements, simply omit it.

Periodicals:	Author 1.; Author 2.; Author 3.; etc. Title of Article. <i>CASSI Abbreviation of Journal Title</i> [Online] Year , <i>Volume</i> (Issue), page numbers. URL (accessed Month Day, Year).
	Print: Caruso, R. A.; Caruso, F. Multilayered Titania, Silica, and Laponite Nanoparticle Coatings on Polystyrene Colloidal Templates and Resulting Inorganic Hollow Spheres. <i>Chem. Mater.</i> 2001 , <i>13</i> , 400-409.

	<p>Online: Fine, L. Einstein Revisited. <i>J. Chem. Educ.</i> [Online] 2005, 82, 1601. http://jchemed.wisc.edu/Journal/Issues/2005/Nov/abs1601.html (accessed Oct. 15, 2005).</p>
Book without Editors	<p>Author 1.; Author 2.; Author 3.; etc. Chapter Title. In <i>Book Title</i> [Online]; Edition Number; series information; Publisher: place of publication, year; Volume Number, pages. URL (accessed Month Day, Year).</p> <p>* "In" is only placed in front of the <i>Book Title</i> if you are referencing a specific chapter</p> <p>Print: Le Couteur, P.; Burreon, J. <i>Napoleon's Buttons: How 17 Molecules Changed History</i>; Jeremy P. Tarcher/Puynam: New York, 2003; pp 32-47.</p> <p>Online: Tour, J. M. <i>Molecular Electronics: Commercial Insights, Chemistry, Devices, Architecture and Programming</i> [Online]; World Scientific: River Edge, NJ, 2003; pp 177-180. http://legacy.netlibrary.com/ebook_info.asp?product_id=91422&piclist=19799,20141,20153 (accessed Nov. 7, 2004).</p>
Book with Editors	<p>Author 1.; Author 2.; Author 3.; etc. Chapter Title. In <i>Book Title</i>, edition Number; Editor 1., Editor 2., etc., Eds.; series information; Publisher: place of publication, year; Volume number, pages.</p> <p>* "In" is only placed in front of the <i>Book Title</i> if you are referencing a specific chapter</p> <p>Almlof, J.; Gropen, O. Relativistic Effects in Chemistry. In <i>Reviews in Computational Chemistry</i>; Lipkowitz, K. B., Boyd, D. B., Eds.; VCH: New York, 1996; Vol. 8, pp 206-210.</p> <p>*note here that volume is not italicized (like with periodicals) and is indicated by 'Vol. #'. The logic is that most books do not have volumes (unlike periodicals), and an italicized number by itself would not immediately be recognizable to most readers.</p>
Government publications	<p>Author 1.; Author 2.; etc. Chapter Title. <i>Document Title</i>; Government Publication Number; Publishing Agency: place of publication, year; pages.</p>

	Dey, A. N.; Bloom, B. <i>Summary Health Statistics for United States Children: National Health Interview Survey, 2003</i> ; DHHS Publication PHS 2005-1551; Prevention, National Center for Health Statistics, U.S. Government Printing Office: Washington DC, 2005.
Technical Reports and Bulletins	Author 1.; Author 2., etc. <i>Title of Report or Bulletin</i> ; Technical Report or Bulletin; Publisher: Place of Publication, Date; Pages. Campton, S.B.; McAllaster, D.R. <i>Collision and Motional Averaging Effects in Cryogenic Atomic Hydrogen Masers</i> ; WMS-AFOSR-002; NTIS: Springfield, VA, 1983; 2-7.
Data Sets	<i>Title</i> ; Publisher: Place of Publication, Date; Data Entry Number/Figure Title/other identifying information. <i>The Sadtler Standard Spectra: 300 MHz Proton NMR Standards</i> ; Bio-Rad, Sadtler Division: Philadelphia, PA, 1994; No. 7640 (1-Chloropentane).
Material Safety Data Sheets	<i>Title</i> ; MSDS Number [Online]; Manufacturing Company: Location of Company, Date. URL (accessed Month Day, Year). Print: <i>Titanium Dioxide</i> ; MSDS No. T3627; Mallinckrodt Baker: Phillipsburg, NJ, Nov 12, 2003. Online: <i>Acetic Anhydride</i> ; MSDS No. A0338 [Online]; Mallinckrodt Baker: Phillipsburg, NJ, Feb 18, 2003. http://www.jtbakerr.com/msds/englishhtml/a0338.htm (accessed Nov 10, 2004).
Websites	Author. Title of Site. URL (accessed Month Day, Year). Northern Illinois University. Department of Chemistry and Biochemistry Home Page, http://www.chembio.niu.edu (accessed Nov 7, 2004).

Miscellaneous Formatting

When recording numbers with units of time or measurement, separate the number and the unit with a space. Exceptions to this are %, \$, ° (angular degrees), ‘ (angular minutes), and ‘ (angular seconds). For example:

6 min
90 °F

25 mL
47°8'23"

125 V/s
50%

Use italics when describing positional, stereochemical, configurational, and descriptive structural prefixes. For example:

ar-chlorotoluene *cis*-[PtCl₂(NH₃)₂] *o*-dibromobenzene
5-*sec*-butylnonane (*E,E*)-2,4-hexadienoic acid *trans*-2,3-dimethylacrylic acid

Reporting Analytical Data:

Below are various templates for reporting your analytical data. The examples are center-aligned for readability. When writing, incorporate as normal in the written text.

Melting Point and Boiling Point:

mp {experimental value} °C (lit. ^{citation} mp {literature value})

mp 175.5 °C (lit.²⁵ mp 175-176)

Commonly Used Abbreviations: mp – melting point, bp – boiling point, lit. – literature value, dec – decomposition

Specific Rotation:

$[\alpha]_{\lambda}^T + \{\text{degree observed}\} (c \{\text{concentration}\}, \{\text{solvent chemical structure}\})$

$[\alpha]_D^{20} + 25.4 (c \ 1.00, CHCl_3)$

Commonly Used Abbreviations: α – specific rotation, *c* - concentration

¹H NMR Spectroscopy:

¹H NMR ({machine frequency} MHz, {solvent chemical structure}, δ): {highest ppm reported} ({peak type}, {coupling constant}, {amount of protons in peak}, {structure/s causing peak}), {second highest ppm reported} ({peak type}, {coupling constant}, {amount of protons in peak}, {structure causing peak}), ..., {lowest ppm reported} ({peak type}, {coupling constant}, {amount of protons in peak}, {structure causing peak}).

¹H NMR (400 MHz, CD₃OD, δ): 8.73 (s, 3H, -OCH₃), 7.50 (s, 1H, CH), 7.15 (d, *J* = 8.2 Hz, 1H, *Ar H*), 6-3 (br s, 5H, *NH* and *NH*₂).

¹³C NMR Spectroscopy:

¹³C NMR ({solution}, δ): {highest ppm reported} ({peak type}, {coupling constant}, {structure}), {second highest ppm reported} ({peak type}, {coupling constant}, {structure}), ..., {lowest ppm reported} ({peak type}, {coupling constant}, {structure}).

¹³C NMR (DMSO-*d*₆, δ): 175.4 (C=O), 156.5 (C₄), 147.4 (C₆), 138.3 (C₂), 110.5 (d, *J*=11.3 Hz, C₅), 52.3 (CH₃), 28.4 and 28.8 (C₇).

IR Spectroscopy:

IR type (cm^{-1}) $\bar{\nu}_{\text{max}}$: {highest peak measurement} ({peak type}, {structure and movement}, {functional group}), {second highest peak measurement} ({peak type}, {structure and movement}, {functional group}), ..., {lowest peak measurement} ({peak type}, {structure and movement}, {functional group}).

FTIR (cm^{-1}) $\bar{\nu}_{\text{max}}$: 2979 (w, C-H stretching, alkane), 1400 (m, C-H stretching, alkane), 1264 (s, C-O stretching, alkyl aryl ether), 827 (vs, C=C bending, alkene).

Commonly Used Abbreviations: w – weak, m – medium, s – strong, vw – very weak, vs – very strong, br – broad.

Mass Spectrometry

MS m/z (relative intensity): {highest molecular weight reported} ({%}), {second highest molecular weight reported} ({%}), ..., {lowest molecular weight reported} ({%}).

MS m/z (relative intensity): 238.2058 (44.8%), 195.1487 (100%), 153.1034 (21.2%).

Figures*:

Every figure must have a caption that includes the figure number and a brief, informative description in fragment format. The caption must be understandable on its own, meaning it should be understandable what is happening in the figure without the aid of the paper. Figure captions appear below the figure itself. In Microsoft Word, select 'References' > 'Insert Caption' > 'Figure.' Using this method, it is recommended to remove the italics and make the text black. The caption text is often smaller than the body text, so if your body is font size 12, make your caption font size 10. For example:

Figure 4. Change in carotenoid contents during maturation of three varieties of grapes: (A) Concord grapes; (B) Thompson seedless; and (C) Chilean red).

Figure 1. Specificity of bovine muscle LDH antibodies in a sandwich ELISA. Data represent the averages of three replicates.

To reference a figure in your paper, capitalize Figure and number by order of discussion in the text. For example:

The block copolymers may contain a small but detectable fraction of impurities, as shown by Figures 1 and 2.

Figures 3-5 show the production of acid relative substances in three different oils.

Tables*:

Every table must have a caption that includes the table number and a brief, informative description in fragment format. The caption must be understandable on its own,

meaning it should be understandable what information is being shown in the table without the aid of the paper. Table captions go above the table itself. In Microsoft Word, select 'References' > 'Insert Caption' > 'Table.' Using this method, it is preferable to remove the italics and make the text black. The caption text is often smaller than the body text, so if your body is font size 12, make your caption font size 10. Table font size should be the same as the caption text size, so if your caption is font size 10, the font of your table should also be 10. For example:

Table 2. Conditioned WRA and Mechanical Strength of Plain-Weave Cotton Fabric Treated with Different Cross-Linking Agents^a

Table 5A-3. Text and Image formats Acceptable to Different Web-Based Manuscript Submission Systems

Tables may have footnotes that provide more information below the table itself. For example, a footnote for the first example above would be:

^aThe concentrations of PMA, BTCA, and NaH₂PO₂ are calculated on the basis of 100% active ingredient; the concentration of DMDHEU is based on the weight of the commercial product, which contains 55% solid. The wet pickup of the treated fabric is approximately 105-110%.

To reference a table in your paper, capitalize Table and number by order of discussion in the text. For example:

Table 1 discusses the ancestry of mutations in the peripheral blood samples.

Possible target RNAs of the RIDD pathway in mouse cells are listed in **Table 5**.

* To bold your Figure or Table label is an option. The examples for labeling a figure/table and referencing a figure/table in-text show the unbolded and bolded options. Choose one and be consistent throughout the paper.