Journal of the American Society for Information Science and Technology

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| Journal: | *Journal of the American Society for Information Science and Technology* |
| Manuscript ID: | JASIST-2008-06-0204.R2 |
| Wiley - Manuscript type: | Research Article |
| Date Submitted by the Author: | 08-Aug-2008 |
| Complete List of Authors: | Neuhaus, Christoph; ETH Zurich, Professorship for Social Psychology and Research on Higher Education<br>Marx, Werner; Max Planck Institute for Solid State Research<br>Daniel, Hans-Dieter; ETH Zurich, Professorship for Social Psychology and Research on Higher Education; University of Zurich, Evaluation Office |
| Keywords: | bibliometrics < informetrics < measurement < quantitative research < (research and analytic methods) |
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# The publication and citation impact profiles of *Angewandte Chemie* and the *Journal of the American Chemical Society* based on the sections of *Chemical Abstracts* – A case study on the limitations of the Journal Impact Factor



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## Abstract

The Journal Impact Factor (JIF) published by Thomson Reuters is often used to evaluate the significance and performance of scientific journals. Besides methodological problems with the JIF, the critical issue is whether a single measure is sufficient for characterizing the impact of journals, particularly the impact of multidisciplinary and wide-scope journals that publish papers in a broad range of research fields. Taking *Angewandte Chemie International Edition* and the *Journal of the American Chemical Society* as examples, we examined the two journals' publication and impact profiles across the sections of *Chemical Abstracts* and compared the results with the JIF. The analysis was based primarily on Communications published in *Angewandte Chemie International Edition* and the *Journal of the American Chemical Society* during the period 2001 to 2005. The findings show that the information available in the *Science Citation Index* is a rather unreliable indication of the document type and is therefore inappropriate for comparative analysis. The findings further suggest that the composition of the journal in terms of contribution types, the length of the citation window, and the thematic focus of the journal in terms of the sections of *Chemical Abstracts* has a significant influence on the overall journal citation impact. Therefore, a single measure of journal citation impact such as the JIF is insufficient for characterizing the significance and performance of wide-scope journals. For the comparison of journals more sophisticated methods such as publication and impact profiles across subject headings of bibliographic databases (e.g. the sections of *Chemical Abstracts*) are valuable.


Keywords: Journal Impact Factor, multidisciplinary journals, wide-scope journals, Chemical Abstracts, impact profile

## Introduction

Since 1975 the Institute for Scientific Information (today owned by Thomson Reuters) has reported the Journal Impact Factor (JIF) of selected scientific journals in the annual publication *Journal Citation Reports* (Garfield, 2006). The citation-based JIF is seen as a measure of the significance and performance of scientific journals, and it is certainly the best-known bibliometric indicator for journals (Garfield, 2006; Glänzel & Moed, 2002). The JIF of a journal in year t is defined as a ratio: The numerator is the number of citations in t given to papers published in t-1 and t-2 and the denominator is the number of citable papers published in the journal in the years t-1 and t-2. The definition of the JIF and its application in journal evaluation are controversial. Its correctness, sense, and use are critically discussed by bibliometricians and scientists (Opthof, 1997; Seglen, 1997; The PLoS Medicine Editors, 2006; van Leeuwen, Moed, & Reedijk, 1999). In particular, the value of the JIF is seriously affected by four factors: (a) the definition of citable documents as research articles, notes, and reviews, which inflates the JIF of journals containing a high number of non-citable documents such as editorials and letters to the editor (calculating the JIF, non-citable documents are excluded from the denominator but citations to these documents are included in the numerator), (b) the composition of a journal in terms of types of contributions, which favors journals containing a high number of reviews, (c) the length of the JIF citation window, ranging from 1 to 3 years, which is too short for fields that do not reach maximum impact until three or even more years after publication, and (d) the research field(s) covered by a journal, since citation habits differ considerably among research fields and even subfields (Rousseau, 2002; van Leeuwen & Moed, 2002).

Several attempts have been made to improve the JIF and its significance (see Glänzel & Moed (2002) for a review on modifications of the JIF). An alternative journal impact measure that takes into account the four flaws mentioned above is the *Journal to Field Impact Score* (van Leeuwen & Moed, 2002) . To obtain a field-normalized score, the impact of a journal is compared with the average number of citations to the field(s) to which the journal belongs. Fields are thereby defined by a classification of journals into subject categories originally developed by the Institute for Scientific Information. Each journal is assigned as a whole to one or several subject categories. In 2006, the Science Edition of *Journal Citation Reports* used 172 subject categories for the classification of journals. In general, the journal classification scheme is useful in journal evaluation. It is limited, however, in the case of multidisciplinary journals such as *Nature*, *Science*, *Proceedings of the National Academy of Sciences*, and wide-scope journals such as *Angewandte Chemie* and *Journal of the American Chemical Society* (Glänzel, Schubert, & Czerwon, 1999; Neuhaus & Daniel, accepted for publication). These journals publish papers in a broad range of research fields and subfields, respectively, and are therefore classified as "multidisciplinary sciences" and "chemistry, multidisciplinary", respectively. In terms of content, multidisciplinary and wide-scope journals are rather heterogeneous, and their papers originate from research fields with diverse citation habits. They incorporate papers from highly cited fields, such as immunology and microbiology, as well as papers from lowly cited fields, such as computational chemistry. This raises the question as to whether comparative analyses based on the JIF, or any modification thereof, are appropriate for describing and evaluating multidisciplinary and wide-scope journals. Another question is whether a single measure is sufficient or insufficient for characterizing the impact of journals (Glänzel & Moed, 2002; Rousseau, 2002).

Taking the journals *Angewandte Chemie International Edition* (AC) and the *Journal of the American Chemical Society* (JACS) as examples, the present study examines the question of whether the sections of the bibliographic database *Chemical Abstracts* are valuable for characterizing and comparing wide-scope journals in chemistry and related fields. The study investigates the publication and impact profiles of the two journals and compares the results with the JIF and other measures of journal citation impact.

## Methodology and data

The journals AC and JACS are perhaps the two most renowned chemistry journals worldwide, which can be seen not least in their exceptionally high JIFs. For 2006 AC has a JIF of 10.232 and JACS a JIF of 7.696. Only three review journals (*Chemical Reviews*, *Chemical Society Reviews*, and *Accounts of Chemical Research*) have a higher JIF than AC in the subject category "chemistry, multidisciplinary" of *Journal Citation Reports*.

For several reasons, comparison of AC and JACS based on the JIF and other overall measures of journal citation impact such as the SCImago Journal Rank (see http://www.scimagojr.com), the Eigenfactor and the Article Influence (see http://www.eigenfactor.org) is problematic. In the case of AC, correct determination of the JIF is beset with some problems. Since 1962 the journal *Angewandte Chemie* has been published not only in the original German edition but also in an English-language edition, the *Angewandte Chemie International Edition*. Some authors cite papers published in AC with reference to both, the German edition and the *International Edition*. As a result, citations to the AC are counted twice, thus artificially inflating the impact of AC. Several studies found evidence that the JIF of AC as published in the *Journal Citation Reports* is overrated (Braun & Glänzel, 1995; Marx, 2001; Moed, van Leeuwen, & Reedijk, 1996; van Leeuwen, Moed, & Reedijk, 1997). In turn, completely ignoring citations to the German edition results in an underestimation of the impact of individual papers published in AC. For all papers published in the period 2001-2005 and cited in the same time period, we ascertain through "Journal Title Matching" (Marx, 2001) a percentage of *at maximum* 14% for double citations and approximately 2% for publications citing the German edition exclusively.

Furthermore, comparative analyses of the impact of AC and JACS are hindered by the different composition of the journals in terms of types of contributions. The majority of papers in AC appear under the “Communication” type of contribution, whereas JACS publishes research findings in its “Article” and “Communication” types of contributions. Unlike JACS, AC also publishes "Reviews". The scope of the different types of contributions is described in the author guidelines of AC (2008) and the JACS (2008). As the average citation rate of Communications and Articles differs clearly from the average citation rate of Reviews, comparing the two journals is problematic as long as the different distribution of contribution types is not taken into consideration (van Leeuwen & Moed, 2002).

Finally, the journal classification of AC and JACS as “chemistry, multidisciplinary” says relatively little about the orientation of the content of the two journals. For a more sophisticated characterization of journals, the controlled classification of bibliographic databases related to the specific papers rather than journals can be a useful basis (Neuhaus & Daniel). The present study utilizes the bibliographic database *Chemical Abstracts* in order to be able to describe the publication and impact profiles in detail (Daniel, 1991). The database, which is published by Chemical Abstracts Service, represents the world’s most important compendia of published literature in chemistry (Chemical Abstracts Service, 1999). *Chemical Abstracts* is divided into 80 different sections (see Chemical Abstracts Service (1997) for detailed descriptions of all sections). The sections are collected in five broad headings of chemical research.

According to main subject thrust and interest, each individual paper is assigned to only one section and subsection. If the subject matter is appropriate to other sections, cross-references are also established. In contrast to the classification of journals in *Journal Citation Reports*, in this procedure in *Chemical Abstracts* also papers that were published in multidisciplinary and wide-scope journals are assigned to a specific field. Using the sections of *Chemical Abstracts* for bibliometric analysis, we must assume that the subject classification of *Chemical Abstracts* is not affected by what is called the "indexer effect". That is, we assume that indexers assign the papers to the relevant sections. According to Braam and Bruil (1992), the indexing of *Chemical Abstracts* in 80 sections accords with author preferences for 80% of papers. The sections of *Chemical Abstracts* thus seem to be a promising basis for describing and comparing the publication and impact profiles of journals.

For bibliometric analysis we used the SCISEARCH (*Science Citation Index Expanded*) and CAplus (*Chemical Abstracts*) databases available through STN International (Marx, Schier, & Wanitschek, 2001; Ridley, 2001). In SCISEARCH we retrieved all papers published in AC and JACS in the period 2001 to 2005. In a second step, we extended the data with information on the contribution types as classified by the journals themselves. For AC, the information was provided by the editor. For JACS, the information was obtained from the Web site of the American Chemical Society (see http://pubs.acs.org/journals/jacsat).

Table 1 shows the number of papers by contribution type as classified by SCISEARCH and the journals themselves. In the case of AC, research articles as defined by SCISEARCH comprise papers appearing under the contribution types "Communication", "Highlight", "Essay", and others, whereas in the case of JACS, research articles denote to papers published in the contribution types "Articles" and "Communications". According to the definition of AC (2008) Communications "[...] are short notes on experimental and/or theoretical studies in all branches of chemistry". JACS (2008) stresses the criteria of urgency in its definition: "Communications are restricted to reports of unusual urgency, timeliness, significance, and broad interest". Communications are thus characterized by immediacy and shortness of reporting research findings and differ in this respect from research articles and reviews. Further, the classification of SCISEARCH suggests that JACS also publishes reviews, although JACS does not publish any paper under this contribution. Thus, the information in SCISEARCH is a rather unreliable indication of the contribution type and is inappropriate for comparative analysis.

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Insert Table 1 about here

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The present paper focuses primarily on Communications as classified by the journals themselves. For better comparability, articles, reviews and other documents were not taken into account. Although both SCISEARCH and CAplus include cited references (Neuhaus & Daniel, 2008; Whitley, 2002), permitting assessment of the impact of publications, citation counts were determined exclusively in SCISEARCH for the present study. This preserves comparability with the JIF and with earlier studies on the impact of AC and JACS. The number of citations was assessed for the same period as for the number of publications, from 2001 to 2005, applying a variable citation window. For AC, only citations to the English edition were counted, resulting in a slight underestimation of the impact of AC. As mentioned above, for the period 2001-2005 approximately 2% of the impact of AC originates from publications exclusively citing the German edition.

In order to explore the publication and impact profiles, the data were extended with information on the *Chemical Abstract* (CA) sections. As section numbers and section titles may change over time, it is indispensable to browse in advance the section thesaurus in CAplus (Chemical Abstracts Service, 2004). For the present study covering the time period 2001-2005, neither section numbers nor section titles changed. With the exception of 16 Communications, the section could be assigned successfully to the Communications published in AC and JACS. The Communications concerned and their citations are excluded from the analysis by CA sections.

In the statistical analysis, the publication and impact profiles of AC and JACS are compared using chi-square goodness-of-fit tests, Spearman's rank correlation, and Cattell's profile similarity coefficient. The average citation rate and its confidence intervals are estimated by a negative binomial model.

## Results

### *Measures of journal citation impact*

Table 2 shows the number of Communications published in AC and JACS, the number of citations received by these Communications, and the average number of citations per Communication for the period 2001-2005. Apparently, the publication activity of JACS is more than 1.5 times higher than of AC. The difference in the average citation rate of Communications published by AC and JACS is small (11.4 vs. 13.0), whereby the impact of AC is underestimated in this analysis, as the citations of the German edition were not considered. Table 2 also reports the percentage of Communications not cited during the period under study; the difference between the journals is small (16.4% vs. 14.8%).

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Insert Table 2 about here

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### *Composition in terms of contribution types*

Table 1 reveals that AC and JACS differ regarding the composition in terms of types of contribution. AC publishes mainly in the contribution types “Communication”, “Highlight” and “Review”, whereas JACS publishes papers under the contribution types “Article” and Communication”. In JACS, Communications account for 49.2% and Articles for 50.8% of all papers. In AC, Communications are of particular importance, accounting for 88.2% of all papers; Highlights account for 5.0% and reviews for only 4.4% of all papers. Overall, the average citation rate of papers published by AC is 13.4 (compared to 11.4 for Communications) and 13.2 for JACS (compared to 13.0 for Communications only). Table 2 shows, however, that the average citation rate of contribution types differs significantly. In AC, for example, reviews are cited on average significantly more frequently than Communications (56.3 vs. 11.4 citations).

***Length of citation window***

Table 3 compares the short-term impact and the mid-term impact of Communications published by AC and JACS. The citation window ranges from 1 year to 5 years. The differences in the average citation rate show that the AC Communications have a higher impact than the JACS Communications in the first year after publication, but that JACS steadily extends its lead afterwards.

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Insert Table 3 about here

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***Thematic focus in terms of CA sections***

In the following, we describe the publication and impact profiles of AC and JACS.

Firstly, we report the findings by the broad headings of *Chemical Abstracts*, into which the 80 individual sections are collected. Next, we describe the profiles by CA section, unveiling the characteristics of AC and JACS in more detail.

**Analysis by headings.** Table 4 shows the distributions of the Communications in AC and JACS and their citations among the main areas of chemical research used by *Chemical Abstracts*. For both journals, the majority of the Communications fall under the broad heading organic chemistry (AC: 48% vs. JACS: 40%), followed by physical, inorganic, and analytical chemistry (29% vs. 24%) and biochemistry (13% vs. 26%). The headings macromolecular chemistry and applied chemistry play a subordinate role for the two journals, with less than 10% of the published Communications falling under these two headings in the period 2001-2005. A similar picture is revealed for the citations: AC and JACS accumulate the larger part of their citations under the heading organic chemistry (49% vs. 44%), once again followed by physical, inorganic, and analytical chemistry (31% vs. 25%) and biochemistry (10% vs. 21%).

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Insert Table 4 about here

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We compare the publication and impact profiles of AC and JACS with the chi-square goodness-of-fit test. This test allows verification of whether the observed percentages for the headings and sections, respectively, are significantly different from expected percentages. In the comparison of the publication and impact profiles with the chi-square goodness-of-fit test, the percentages of AC are treated as observed values and the percentages of JACS as expected values. The goodness-of-fit test reveals that the publication profiles of AC and JACS differ in a statistically significant way ($\chi^2(4) = 447.1$, $p < .01$). The difference in the impact profiles is statistically significant as well ($\chi^2(4) = 4812.5$, $p < .01$). For one, the percentage of publications under the biochemistry heading is twice as high in JACS (26%) as in AC (13%). For another, approximately half of the publications in AC fall under the organic chemistry heading (48%), which is 8 percentage points higher than the percentage of organic chemistry publications in JACS (40%). The findings are similar for the citations: the percentage of citations that fall under the biochemistry heading is more than twice as high for JACS (21%) as for AC (10%); in contrast, the percentage of citations that fall under the organic chemistry heading is 5% higher for AC (49%) than for JACS (44%).

Finally, we estimate a negative binomial regression model to determine the mean values and the 95% confidence intervals of the citations per publication (CPP) indicator by heading. The negative binomial regression model is used in bibliometric analyses, because the distribution of citation counts is overdispersed (Bornmann, Mutz, Neuhaus, & Daniel, 2008; Schubert & Glänzel, 1983). That is, the variance of the distribution is greater than might be expected in a Poisson regression model. The negative binomial regression model accounts for overdispersion by adding a parameter alpha that reflects unobserved heterogeneity among observations (Long & Freese, 2003). Figure 1 shows mean values and confidence intervals by heading. Apparently, the exactness of the estimates is very different for the individual headings. The large confidence intervals for macromolecular chemistry and applied chemistry are not surprising, as AC and JACS published only few Communications in these areas, and a small sample size leads generally to a large confidence interval. On the basis of the confidence intervals it is also clear that the impact of AC and JACS in biochemistry, organic chemistry, and applied chemistry differs statistically significantly. The confidence intervals of the different headings do not overlap, and JACS reaches a higher impact in these three headings than AC. The difference in impact between AC and JACS is by far the greatest in the area of organic chemistry. The differences in macromolecular chemistry and physical, inorganic, and analytical chemistry are not statistically significant.

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Insert Figure 1 about here

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**Analysis by sections.** For each Communication in AC and JACS, the section assigned by *Chemical Abstracts* was assessed. Figure 2 shows the percentage of Communications and the percentage of their citations plotted against the 80 CA sections. The two journals' profiles are very similar overall. Spearman's rank correlation coefficient, which describes the degree of agreement between the profiles of AC and JACS, is $r = .87$ ($p < .01$) for the publication profiles and $r = .84$ ($p < .01$) for the impact profiles. A look in detail reveals that AC most frequently publishes Communications on research findings in sections 78 (inorganic chemicals and reactions, 13%), 29 (organometallic and organometalloidal compounds, 11%), and 22 (physical organic chemistry, 8%). Whereas 60% of all Communications published in AC fell under these three sections in the year 1984 (Daniel, 1993, 2004), this percentage decreased to 32% in the period 2001-2005. In JACS also, sections 29 (organometallic and organometalloidal compounds, 9%) and 22 (physical organic chemistry, 8%) are of comparatively large quantitative significance, and in addition to that, JACS also frequently publishes Communications in section 6 (general biochemistry, 8%).

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Insert Figure 2 about here

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For the indicator citations per publication (CPP) only those sections were considered in which both AC and JACS published at least 20 Communications each in the period observed; 38 sections met this condition. Figure 3 shows the impact profiles of AC and JACS. First, we analyzed differences in the impact profiles of AC and JACS. Cronbach and Gleser (Cronbach & Gleser, 1953) distinguish among three components of profile similarity: (a) *elevation* is the mean of all scores, in this case the values of the CPP indicator for AC and JACS, respectively, (b) *scatter* describes the deviation of scores from their mean, and (c) *shape* is the residual information in the scores after equating profiles for both elevation and scatter. For the CPP indicator, we estimate the similarity of the profiles using $r_p$, Cattell's profile similarity coefficient (Cattell, 1949), which combines all three components of profile similarity into a single number. The coefficient ranges from +1.0 when two profiles are identical, to 0.0 when the similarity is no greater than chance and to -1.0 when the dissimilarity becomes as great as it can be. For AC and JACS, we calculated a profile similarity coefficient of $r_p = .86$ ($p < .01$) (Horn, 1961). The size of the correlation coefficient is interpreted as usual (Cohen & Cohen, 1975): correlations > .8 are considered to be very high, so that regarding the CPP indicator, the impact profiles of AC and JACS are very similar.

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Despite the high profile similarity, there are differences in the profiles of AC and

JACS. Apparently, Communications in JACS achieve a higher impact than AC throughout, with the exception of sections 22 (physical organic chemistry), 30 (terpenes and terpenoids), 65 (general physical chemistry), 67 (catalysis, reaction kinetics, and inorganic reaction mechanisms), 76 (electric phenomena), 77 (magnetic phenomena), 79 (inorganic analytical chemistry), and 80 (organic analytical chemistry). Overall, JACS reaches a high impact mainly with the Communications in biochemistry and organic chemistry, whereas AC stands out in physical, inorganic, and analytical chemistry. The greatest differences in the CPP indicator are found in sections 52 (electrochemical, radiational, and thermal energy technology) and 38 (plastics fabrication and uses) in favor of JACS, and section 79 (inorganic analytical chemistry) in favor of AC.



**Discussion and conclusions**

The good performance of JACS regarding citation impact of Communications across the sections of *Chemical Abstracts* contradict AC's higher values of JIF. As mentioned above, in this period the JIF of AC is overrated by a maximum of 14% due to double citations. By determining the value of the JIF through "Journal Title Matching", Thomson Reuters does not eliminate the double citations to both the German edition and the *International Edition* of AC (Marx, 2001). The present analysis, however, included only citations to the *International Edition*, so that the citations of AC papers originating from publications exclusively citing the German edition are underestimated by approximately 2% .

Additionally, differences in the ageing behavior of scientific literature (Glänzel & Schoepflin, 1994, 1995) has to be considered. For example, letters (also denoted as short or brief communications and not to be confused with letters to the editor) have greater immediacy, but the citation curve declines rapidly after the citation rate has reached a maximum 2 to 3 years after publication. One can assume that the authors go on to publish full papers or other papers that supersede their earlier short communications (Garfield, 1998). As a result, letter journals accumulate a large percentage of their citations within the time period of the JIF. In fact, the *Immediacy Index*, which indicates how quickly papers in a journal are cited, is higher for AC (2.1) than for JACS (1.5) in the 2006 edition of the *Journal Citation Reports*. However, consequently assuming that the Communications of AC have a stronger character of Letters than JACS is questionable, given the average page count as a rough estimation of the paper's length and the average cited reference count. On average, Communications span 4.0 pages in AC and 2.0 pages in JACS. Communications cite on average 31.6 papers in AC and 23.0 papers in JACS. Anyway, the JIF is biased towards journals showing rapid maturing and declining in impact (Moed, van Leeuwen, & Reedijk, 1999) and is therefore only partly useful for comparing journals having different contribution type characteristics, such as AC und JACS.

Furthermore, in the analysis only Communications are considered, which puts AC at a disadvantage. Although it is true that overall the Communications produce the greater part of the total impact of AC, Reviews are cited on average more frequently than Communications (Marx, 2001; Moed et al., 1996). Only 4.4% of the papers published in AC are Reviews, but the Reviews account for 18.4% of the overall citations to the journal. As Reviews published by AC in the period 2001-2005 are cited on average 4.9 times more frequently than Communications, the total impact of AC is slightly higher than the total impact of JACS.

Finally, the classification of AC and JACS as "chemistry, multidisciplinary" in the *Journal Citation Reports* says little about the orientation of their contents. Profiling the communications in AC and JACS by the sections of *Chemical Abstracts* unveils the similarities and differences in the publication activity and impact of the journals and thereby show a far more informative picture than can be obtained from the JIF and other journal impact measures.

In summary, the findings show that (a) comparative analysis based on the JIF and other overall measures for journal citation impact are inappropriate for describing and evaluating wide-scope journals, (b) a single measure of journal citation impact is insufficient for characterizing the significance and performance of such journals, and (c) the controlled subject classification of bibliographic databases such as *Chemical Abstracts* are valuable for characterizing and comparing wide-scope journals.

## Acknowledgements

We thank Dr. Peter Gölitz, Editor-in-Chief of *Angewandte Chemie*, and the Max Planck Society for their generous support during the carrying out of the study. Thanks to Dr. Rüdiger Mutz for statistical consulting.

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# Tables

***Table 1*. Contribution Type of Papers Published by Angewandte Chemie and Journal of the American Chemical Society in the Period 2001-2005 as Classified by SCISEARCH and the Journals Themselves**

| Contribution type according to SCISEARCH and the journals themselves (indented stub items) | Number of papers |
|---|---|
| *Angewandte Chemie* | |
| ARTICLE | |
| Communication | 5,034 |
| Essay | 36 |
| Highlight | 284 |
| others | 6 |
| LETTER | |
| Correspondence | 24 |
| REVIEW | |
| Minireview | 68 |
| Review | 249 |
| others | 12 |
| *Journal of the American Chemical Society* | |
| ARTICLE | |
| Article | 6,931 |
| Communication | 7,158 |
| REVIEW | |
| Article | 469 |
| Communication | 1 |

Note. For example, 5,034 Communications published in AC are classified as “Article” in SCIESEARCH.

***Table 2*. Bibliometric Indicators for Papers Published by Angewandte Chemie and Journal of the American Chemical Society in the Period 2001-2005**

| Contribution type according to the journals themselves | Number of papers | Number of citations | Citations per paper | Papers not cited (%) |
|---|---|---|---|---|
| *Angewandte Chemie* | | | | |
| Communication | 5,041 | 57,527 | 11.4 | 16.4 |
| Review | 250 | 14,074 | 56.3 | 8.0 |
| Overall (all contribution types) | 5,713 | 76,657 | 13.4 | 16.2 |
| *Journal of the American Chemical Society* | | | | |
| Communication | 7,159 | 92,726 | 13.0 | 14.8 |
| Article | 7,400 | 99,889 | 13.5 | 14.1 |
| Overall | 14,559 | 192,615 | 13.2 | 14.4 |

Note. 7 of 5,041 Communications published by AC in the period under study are classified as “Review” in SCISEARCH and 1 of 250 Reviews is classified as “Article”.

***Table 3*. Short-Term and Mid-Term Impact of Communications Published by Angewandte Chemie and Journal of the American Chemical Society in the Period 2001-2005**

| Publication year | Length of citation window (years) | AC | JACS | ΔAC-JACS |
|---|---|---|---|---|
| 2005 | 1 | 1.4 | 1.3 | -0.1 |
| 2004 | 2 | 7.4 | 7.9 | 0.5 |
| 2003 | 3 | 13.1 | 14.9 | 1.8 |
| 2002 | 4 | 19.2 | 22.4 | 3.2 |
| 2001 | 5 | 21.8 | 25.7 | 3.9 |

Note. Average number of citations per Communication (including self-citations).

***Table 4*. Relative Number of Communications Published in Angewandte Chemie and Journal of the American Chemical Society, and Their Citations, by *Chemical Abstracts* Heading (2001-2005)**

| Heading | Publications (%) | | Citations (%) | |
|---|---|---|---|---|
| | AC | JACS | AC | JACS |
| Biochemistry | 12.9 | 25.6 | 9.9 | 20.7 |
| Organic chemistry | 48.4 | 40.1 | 48.6 | 43.5 |
| Macromolecular chemistry | 6.5 | 6.7 | 7.4 | 7.6 |
| Applied chemistry | 3.4 | 3.4 | 2.8 | 3.7 |
| Physical, inorganic, and analytical chemistry | 28.8 | 24.3 | 31.3 | 24.5 |

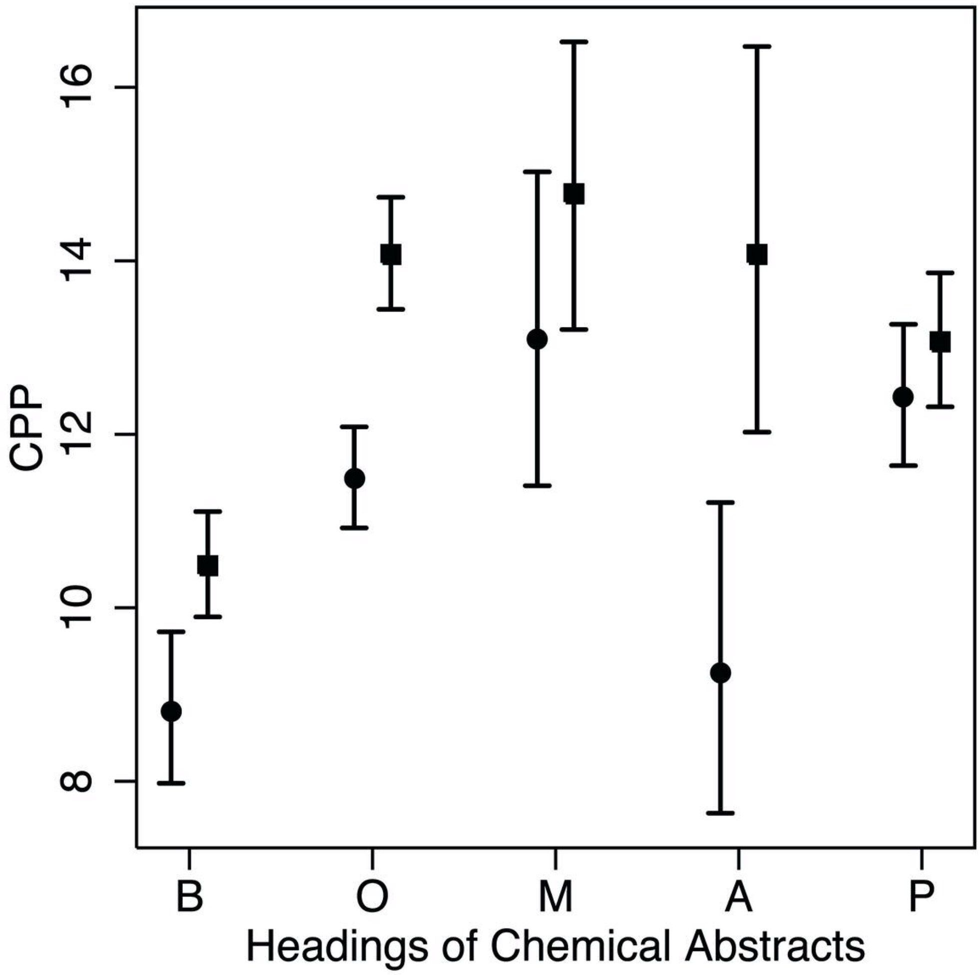


**Figure 1. Mean values and confidence intervals of the CPP indicator for communications published in AC (circles) and JACS (squares), by heading. Note. B = biochemistry; O = organic chemistry; M = macromolecular chemistry; A = applied chemistry; P = physical, inorganic, and analytical chemistry.**

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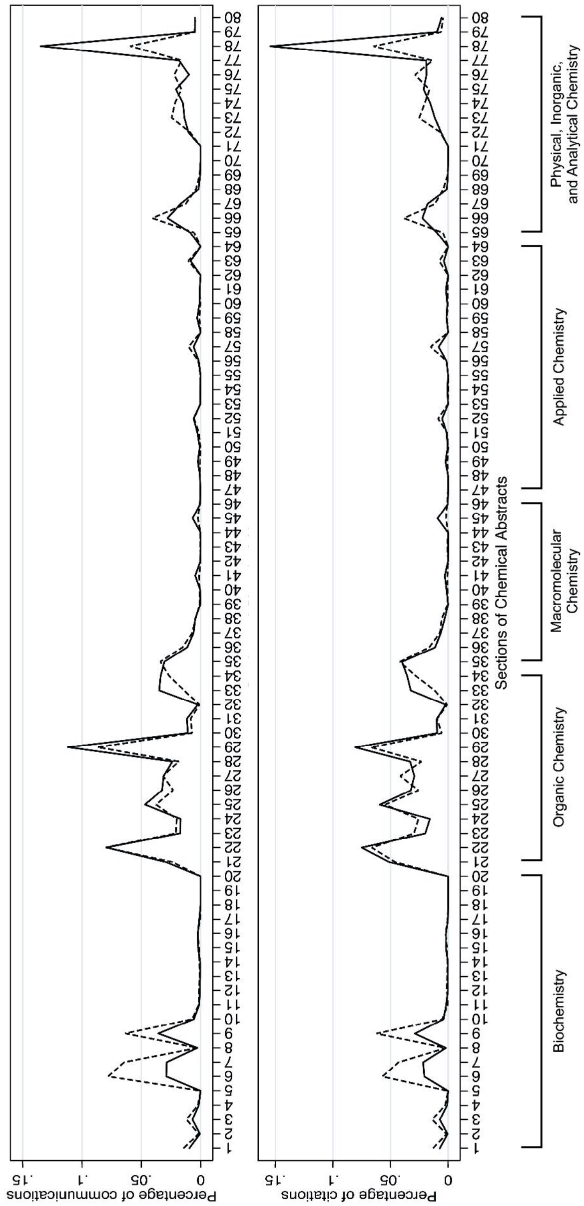


**Figure 2. Publication and citation impact profiles: Percentage of communications and percentage of citations for AC (solid line) and JACS (dashed line) over the sections of Chemical Abstracts. Note. For better readability, data points are connected, although there is no functional relationship between the sections.**

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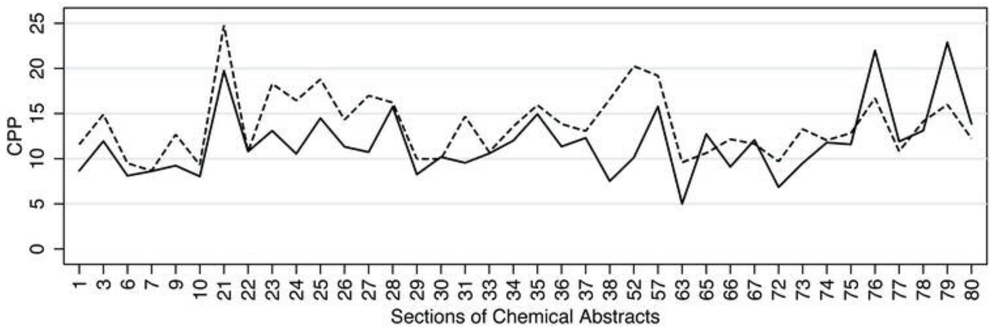


**Figure 3. Citation impact profiles: Average number of citations per communication for AC (solid line) and JACS (dashed line) over the sections of Chemical Abstracts. Note. Only those sections are considered in which both AC and JACS published at least 20 communications each in the period 2001-2005. For better readability, data points are connected, although there is no functional relationship between the sections.**
32x10mm (600 x 600 DPI)