

# Current Comments®

## How to Use Journal Citation Reports, Including a Special Salute to the Johns Hopkins Medical Journal

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The demise of the venerable *Johns Hopkins Medical Journal (JHMJ)* was recently announced in its December 1982 issue.<sup>1</sup> My personal *ASCA*® (*Automatic Subject Citation Alert*)<sup>2</sup> report alerted me to this sad event because, in a farewell editorial, *JHMJ* editor Samuel Boyer referred to *Journal Citation Reports*® (*JCR*™).<sup>3</sup>

I found Boyer's discussion poignant for a personal reason. In tracing the history of *JHMJ*, he referred to my former boss Sanford V. Larkey, whose role in the development of *Index Medicus* I outlined recently.<sup>4</sup> Larkey was the former librarian of the Welch Medical Library at Johns Hopkins University. Boyer also mentioned the data on the world's medical journals that we compiled at the Welch Medical Library Indexing Project back in the early-1950s. Of course, those early citation analyses were very different from the analyses currently provided by *JCR*. But our work indicated that *JHMJ*, then known as the *Johns Hopkins Hospital Bulletin*, was at the time a highly respected, widely cited journal.

Boyer went on to imply that the current *JCR* played a role in the decision to discontinue publication, by confirming the decline in the impact of *JHMJ* articles. Of course, there have always remained a few loyal Johns Hopkins medical researchers who published their best work in the journal. These occasional superstar papers probably boosted the journal's overall citation statistics.

Nevertheless, *JCR* data from 1975 to 1981 clearly show *JHMJ*'s decline in this period.

It is true that, in terms of citations, *JHMJ* has ranked among the top half of journals in *JCR* during this seven-year period. In fact, the number of citations actually increased between 1975 and 1981, from 521 to 592. However, in the last two years the number of citations to *JHMJ* showed a decline from the peak year of 1979, when citations reached 670. Furthermore, in a study of medical journals based on 1981 *JCR* statistics, *JHMJ* ranked 39th out of 71 journals ranked by citations.<sup>5</sup>

But absolute citation counts can be misleading. More telling are the journal's impact factors over this period. The impact factor is a measure of the frequency of citation of the average article published during the two previous years. *JHMJ*'s impact shows a dramatic decline over the seven-year period, from .92 to .36. Interestingly, the impact increased somewhat in 1978 and 1979, in parallel with total citations. This peak might be explained by the publication of a few highly cited papers. But the overall change in status is marked. In 1975, *JHMJ*, with a rank of 821 out of 2,434, was close to the top third of journals in terms of impact. By 1981, with a rank of 2,238 out of 3,836, it slid into the bottom half of all journals.

An even bleaker picture emerges when you consider the journal's immediacy index. This index shows the extent to

## Components of the JCR™

The JCR is made up of five data 'packages' or sections. The five sections are: (1) *Journal Ranking Package*; (2) *Source Data Listing*; (3) *Journal Half-Life Package*; (4) *Citing Journal Package*; and (5) *Cited Journal Package*.

The first section (*Journal Ranking Package*) lists alphabetically science journals cited by *Science Citation Index*®, *Social Sciences Citation Index*® and *Arts & Humanities Citation Index*™ journals. They are then ranked by five different counts or indicators. In addition, an alphabetical list of those social sciences journals cited by the combined *SCI*®/*SSCI*®/*A&HCI*™ data base is included in this package. The final section ranks journals by impact factor within subject categories. It also provides the half-life of the titles.

The second section (*Source Data Listing*) shows the number of articles published by each *SCI* source journal. It also includes the average number of references in review and "non-review" articles it published in these journals in 1981.

The third section (*Journal Half-Life Package*) focuses more closely on the chronological spread in annual journal usage. The first of the two reports cumulates, starting in 1981 and going back ten years, the percentage of citations received in 1981 by yearly volumes of each journal studied. The second report lists the journals in ascending order by a calculation we call "Half-life."

The fourth section (*Citing Journal Package*) shows, for each *SCI* source journal, the journals it cited in 1981, and the chronological spread of items cited.

The fifth section (*Cited Journal Package*) shows, for science journals cited by *Science Citation Index*, *Social Sciences Citation Index* and *Arts & Humanities Citation Index* journals, the citing journals and the chronological spread of items cited.

**A description of the sections in the 1981 *SCI*® *Journal Citation Reports*®.**

which journal articles are cited in the same year that they're published. Even in 1975, *JHMJ*'s immediacy index placed it in the bottom third of all journals, with a rank of 1,385 out of 1,977. By 1979, it had declined to the lowest position—ranked 2,742—a drop in status from which it never recovered.

How can this decline be explained? Primarily by the faculty's inclination to publish in specialty journals rather than in *JHMJ*. The best work of the medical research community at Johns Hopkins simply was not represented in *JHMJ*. And since *JHMJ* was the official organ of the medical school and hospital, it was feared that the work appearing in this journal failed to accurately reflect the high quality of work originating from these institutions. This fear, a well-founded one, was a major factor in the decision to cease publication.

Although the journal clearly could not continue in its present form, discontinuing publication completely may have been premature. Possibly, an abstract bulletin covering all publications of the

medical faculty could have replaced the journal. At first glance, this might seem a difficult undertaking. I've described in a previous essay the problems deans have in keeping tabs on faculty publications.<sup>6</sup> However, our *ASCA* service can make the task relatively easy. Through *ASCA*, a weekly report could be obtained of all articles originating from the medical school and hospital. No doubt most of the articles published would already contain an abstract that could be reprinted.

If it were up to me, I'd include another feature in this hypothetical abstract bulletin—reprints of *Citation Classics*<sup>7</sup> from the Johns Hopkins medical school that have appeared in *Current Contents*® (*CC*®). We've published 11 of these since inaugurating *Citation Classics* in 1977. Such a bulletin might also include citation analyses of the international literature citing the work of the Johns Hopkins faculty. Use of analytical summaries and interesting statistics could keep this section from consuming too much space. Maps showing the impact

of Johns Hopkins medical research on particular research fronts could identify core papers by the faculty.

This tribute to one of my former "homes"<sup>4</sup> also serves as an introduction to a more general discussion of *JCR*. *JHMJ* is not an isolated case. *JCR* is being used to help other journal editors confront equally painful decisions. But none are so blind as those who will not see. Many journals in similar situations persist in publishing, despite clear evidence that they are a burden to everyone concerned. Somehow they rationalize their continuing existence. Even worse, some editors blame me or ISI<sup>®</sup> for their lack of recognition. I continue to receive letters from irate editors asking me why we don't cover their journals, which are of a far lower standard than *JHMJ* ever was.

My feeling is that quality will inevitably be recognized. Mediocrity, however, is always present and we must be adamant about maintaining standards that help us distinguish between the two. At the same time, we must acknowledge that mediocrity has a certain value. I happen to subscribe to the Ortega y Gasset hypothesis, which holds that the work of the scientific elite owes much to that of the average scientist.<sup>8</sup> However, I recognize that this reasoning has limits. Science has its fair share of people who exemplify the Peter principle and, I must say, I'm much more concerned about the large number of these people, who masquerade as serious scientists, than about the small number who commit outright fraud.<sup>9</sup> It is therefore not strange that many such masqueraders are fearful lest citation analysis, or any other objective method, expose their "emperor's new clothes."

I regularly employ *JCR* to support essays on the literature of particular fields. Most recently, I covered the earth sciences<sup>10</sup> and neurosciences.<sup>11</sup> But in the course of reviewing *JHMJ* in *JCR*, I realized that I had not explained *JCR* in

detail for many years. Indeed, I first introduced *CC* readers to *JCR* in 1973, in a short, two-page essay in which I suggested that *JCR* "should significantly affect the future course of scientific publication."<sup>12</sup>

I think it's amusing to recall that the initial price of *JCR* was \$540. Now *JCR* can be obtained for \$250, even though it covers at least three times as much information. We set this low price to encourage its use by editors and publishers. For these users we can also provide grant-rate prices for *Science Citation Index*<sup>®</sup> (*SCI*<sup>®</sup>), of which *JCR* is the last volume in each annual edition. But *JCR* wasn't always part of *SCI*. I announced its incorporation into *SCI* in August 1976,<sup>13</sup> in a *CC* essay that was accompanied by a reprint of the introductory material in the 1976 *JCR*.

*JCR* has undergone considerable change in the intervening years, however, and I believe that reproduction of its introductory information is once again warranted. Following this essay, we've reprinted selected sections of the introduction to the 1981 *JCR*. Though taken from *SCI*, this introductory material applies equally to the *JCR* volume of *Social Sciences Citation Index*<sup>®</sup> (*SSCI*<sup>®</sup>), first published in 1977. When we publish *JCR for Arts & Humanities Citation Index*<sup>™</sup> (*A&HCI*<sup>™</sup>), the same principles will apply. The reprinted pages describe *JCR* and offer cautionary notes on the use of citation analysis. It would be useful to include here a bibliography illustrating the varied uses to which *JCR* has been put. A long list of such papers is included in *JCR* itself.

A decision to cease publication of a journal can only be made after a great deal of research and thought. And if editors are going to use *JCR* in making such decisions, it is essential that they understand what kind of information it can provide. So, if you're an editor deciding whether to cease publication, a scholar trying to assemble a core journal collec-

tion, or a librarian trying to pare down an acquisitions budget, I urge you to review this reprint, and proceed with your citation analysis with care.

As a final note, it is reasonable to ask, in the era of online access, why *JCR* is not yet available online. Since *SCI* is online, one might think it would be easy to include *JCR*. But this statistical data base needs a different repertoire of commands to be optimally useful. So, we are working toward that goal for the near future. Indeed, with the advent of our *Sci-Mate*<sup>™</sup> software,<sup>14,15</sup> it is easy to imagine a new package that would permit the manipulation of *JCR* data on a diskette, which could be mailed to subscribers each year. And it is not unlikely that many existing statistical sorting programs could be readily adapted to such a data base. But closer examination of these possibilities will take some time and effort.

At the same time that I mention the possibilities associated with having *JCR* on floppy disks, I should point out some limitations. *JCR* does not provide data on an article-by-article basis. Recently, we have suggested to the editors of several journals the idea of producing a report that would provide a year-by-year statistical analysis for each article published in a journal. Examination of such data would permit editors to measure the impact of different types of articles, as well as the performance of certain articles in comparison with referee judgments. There is considerable discussion in the literature as to the value of refereeing. If you are an editor or publisher interested in such an article-by-article analysis, please contact me. Incidentally, I will be glad to send to any editor who makes a specific request a copy of the appropriate *JCR* printout for his or her journal.

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# Introduction\*

## Why the Journal Citation Reports® ?

In other parts of this introduction I have tried to explain the source of the data in the *SCI*® *JCR*™, to describe how the material has been summarized and displayed in its various sections, and to help the novice use it for the first time. The *JCR* answers the following types of questions immediately: how often has a particular journal been cited? what journals have cited it? how frequently have particular journals cited it? is it the older or new material that's being cited? what journals does this journal cite? how often does it cite each of them, etc.?

A merely curious browser, or even students or researchers, may reasonably and bluntly ask why these questions should be asked. What is the value of answering these questions? Can it justify a work of the *JCR*'s scope and expense? What is the rationale of such questions, beyond an academic itch to know? Who wants or needs the answers? Why is it necessary to compare journals or to determine their importance? Doesn't the mere fact that a journal is published say—with unarguable economic authority—all there is to be said? Aren't journals published because they are important to someone or to some group? Unfortunately life isn't that simple.

This introduction is no place to go into the complicated economics and politics of scientific and technical journal publication. The subject deserves several doctoral theses. In due course, the *JCR* will undoubtedly stimulate students to undertake them. Suffice it to say the 'authoritative' voice of economics can speak in barely more than a whisper. Indeed it can often hardly be heard from its shaky podium of subsidized and unsubsidized society sponsorship, front- and back-door government support, voluntary and mandatory and 'mandatory-voluntary' page-charge systems, advertising and public relations programs, etc. The sheer economic chaos of much of this important activity is alone good enough reason to attempt to answer questions like those posed above.

For that very reason, the *JCR* should quickly prove itself indispensable to people who cannot rely on economic criteria alone in making basic decisions about journals, since the law of supply and demand is not always allowed to prevail. These include administrators in libraries and information service centers; individual scientists; journal editors and publishers; and those who determine science policy and measure its accomplishments.

Librarians can use the *JCR* to counteract the inertia that too often prevails with regard to journal selection. It's just too difficult; therefore, *ad hoc* decisions are rampant. The *JCR* offers objective evidence of the optimum makeup of general and special journal collections. Its yearly editions will indicate or imply changes the library should consider. The chronological spread of citation counts should be invaluable in optimizing retention schedules. Why keep twenty-five years of a journal on your shelves when 80 to 90% of its cited material is less than six years old? Few libraries in the world have a mandate to collect everything and none can afford it. Most must operate within a budget on which users' journal requests can wreak havoc. Because the *JCR* gives good indication of a journal's overall use, it provides a starting point for true cost-benefit analysis in allocating acquisition funds.

Outside the library or information center's administration offices, the *JCR* can be as useful to the librarian as to the library user. At ISI® we have found the *JCR* to be the most reliable—sometimes the only reliable—indicator of a journal's subject area, and of its orientation within the subject area. One quick scan of the columns showing journals that it cites and that cite it can often be more informative than the best title or statement of a journal's editorial objectives. This capability of the *JCR* is especially useful as multidisciplinary work takes scientists to the borders of their own fields, and perhaps over them into others with less familiar journals and journals of different types. These same cited and citing lists reveal what journals in other fields are linking up with journals in their own. And, a far from trivial matter, the *JCR* can be very helpful in deciding where to publish to reach the audience you want to reach. If, for example, you have a paper that deals with some interesting mathematical aspects of biological problems but is nevertheless definitely a biological paper, the *JCR* can show you which biological journals have the best 'connections' with math, and which are most likely to welcome the paper.

Since publication of the preliminary 1969 edition of the *SCI JCR* we have had many inquiries from journal publishers and editors. Those inquiries seem to me to speak not only for the potential of the *JCR* but also for the managerial acumen of the scientists and business people who expressed immediate interest in *JCR*. As made plain earlier, the *JCR*™ cannot be used alone in evaluating a journal's performance, but it can alone give reliable indication that a thorough evaluation—including use of the *JCR*—may be in order. Has the number of citations dropped in relation to number of articles published? Has the rate of self-citation remained steady at the expected average? How do the self-citing and self-

\*Reprinted from: Garfield E, ed. *Science Citation Index®: Journal Citation Reports®*. 1981.

cited rates compare? How are citations distributed among citing journals within and outside the specialty? What is the impact of the average cited article in comparison with other comparably cited journals? How rapidly—see *Immediacy Index* among the *Definitions*—is the journal's material noted in the references of other journals?

The use of the *JCR* can be of far-ranging significance in a field about which I can say least here—science—its planning, its evaluation, its sociology, its history. Citation analysis can be used to identify and map research fronts; to define disciplines and emerging specialties through journal relationships; to determine the interdisciplinary or multidisciplinary character and impact of research programs and projects.<sup>1</sup> I say least about this, to me the most exciting aspect of its potential, because the *JCR* in its present form is, for such advanced applications, only a sketch of that potential, providing little more than suggestions for further and deeper examination of the massive data bank from which its sections have been extracted. I have made plain above my regret that this book has dimensional limits. Even for the generally straightforward lists of ranked and citing and cited journals, we have had to limit the data presented. For the study of science policy and sociology those limitations are more troublesome to me. I believe the *JCR* in its present form can certainly provide material for innovative research in the field. But it will serve the field best if it does, as I hope, prompt more imaginative analyses than I am competent to attempt. I shall be very disappointed if the *JCR* does not, as any good piece of good scientific work should, stimulate with every answer it gives more questions that need answers.

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## Journals, References, and Citations

A citation index is based on the principle that there is some meaningful relationship between one paper and some other that it cites or that cites it, and thus between the work of the two authors or two groups of authors who published the papers.

ISI's *Science Citation Index*®, *Social Sciences Citation Index*®, and *Arts & Humanities Citation Index*® data bases are stored on magnetic tape, and are thus amenable to extensive manipulation and analysis. In the case of authors, we have been able to identify the frequency with which they and their papers are cited in the literature, over any chosen time period. Counts of this sort are strictly quantitative and objective. But even admitting this limitation, an author's or a paper's frequency of citation has been found to correlate

well with professional standing. It is certainly not the *only* measure, nor one that can be used, for any purpose, in isolation. We do not claim for it the absolute reliability that critics of citation analysis have wrongly imputed to us when they have attacked it. The fact does remain, however, that it provides a useful objective criterion previously unavailable.

Basically the same principle can be used in evaluation of journals, rather than of authors' publications or single papers. When a scientist cites a previously published article, he tells us, in a sense, that he has read it and has some reason for bringing it to our attention. The more frequently a journal's articles are cited, the more the world's scientific community uses that it finds the journal to be a carrier of useful information.

### Evaluating Journals

It has always been and still remains difficult to assess the relative importance of scientific and technical journals. There have been few, if any, totally objective criteria by which to measure them. Researchers and their library colleagues quickly learn what journals are most 'important' for particular disciplines, and countless studies have been carried out to establish 'core-journal' lists. But as research interest and activity extend beyond the basic discipline, as interdisciplinary and multidisciplinary 'mission-oriented' research requires broader journal coverage, the relevance and usefulness of journals outside the disciplinary core may be difficult to determine. Even within the small disciplinary or departmental library, when a choice between journals is dictated by restricted acquisitions budgets, considerations less relevant than scientific merit may all too likely determine or force the choice—politics, sheer habit, relative subscription cost, and so on.

Thus, the *Journal Citation Reports*® (*JCR*) extends the use of citation analysis to examine the relationships among journals rather than among articles and their authors. The *JCR* answers these basic questions: how often has a journal been cited? what journals have cited it? how frequently have *particular* journals cited it? does the cited material in the case of a particular journal come primarily from older articles, newer articles, or does the citation pattern show a chronological consistency? what journals has the particular journal itself cited? how often has it cited each of them? is it citing old material, new material? what part of these counts is due to self-citation? In other words: who uses a particular journal? how frequently? for what purposes?

### The Total Framework

Like any other tool, the *SCI JCR* cannot be used indiscriminately. It is a source of highly valuable information, but that information must be used within a total framework proper to the decision to be made, the hypothesis to be examined, and rarely in isolation without consider-

ation of other factors, objective and subjective. For example, there are undoubtedly highly useful journals that are not cited frequently. Scientists read many such journals for the same reason people read newspapers and other non-scientific periodicals—to keep up with what's going on generally. They may rarely cite such journals in their published work. This does not mean that such uncited or infrequently cited journals are any less useful for their intended purpose than cited journals. It does mean, however, that these journals are written and read for a purpose other than the communication of original research findings and the indispensable summary of research findings provided by reviews.

Another consideration is that citation frequency is sometimes—indeed to some extent must be—a function of variables other than scientific merit. Some such variables may be an author's reputation, the controversy of subject matter, a journal's circulation and its cost, reprint dissemination, its coverage by current-awareness and indexing and abstracting services, society memberships, the availability and extent of libraries' journal collections, national research priorities.

#### Compiling Journal Data

Although the *SCI*<sup>®</sup> *JCR*™ provides citation data about science journals, it is compiled from the *Social Sciences Citation Index*<sup>®</sup> and the *Arts & Humanities Citation Index*<sup>™</sup> data bases as well as the *Science Citation Index*<sup>®</sup> data base.

The use of the combined data bases eliminates the often shadowy boundaries between the sciences and social sciences. Some journals are covered by *SCI* and *SSCI*<sup>®</sup>; others are covered only by *SCI*, but may also be cited extensively by journals in the *SSCI* and *A&HCI*<sup>™</sup> data base. To present a more accurate picture of these journals' citation rates and to include a complete list of the journals which cite them most often, citation data from *SSCI*-only and *A&HCI* journals are incorporated in the *SCI JCR*.

The 1981 *JCR* is based on approximately 8 and a half million citations from the references of over 700,000 articles published in the 1981 issues of some 6,000 *SCI*, *SSCI* and *A&HCI* source journals.

We have made a reasonable effort to include in this analysis all 1981 issues of journals covered by the *SCI/SSCI/A&HCI* data base. However, to publish a 1981 *JCR* in 1982 it was necessary that all material in this analysis be processed by ISI<sup>®</sup> on or before February 13, 1982.

The combined data bases include the first author, journal title, volume, page, and year of every cited and citing article covered in 1981. *JCR* extracts from the bases several types of information, the most essential being:

- titles and years of science journals cited during 1981 and the titles of the 1981 *SCI*, *SSCI* or *A&HCI* journals which cited them.

- titles of 1981 *SCI* journals and the titles and years of all journals which they cited during 1981.

*JCR* counts the similar citation links and tabulates the results in its two "detail" listings, first by citing *SCI* journals and then by cited science journals.

#### Article-to-Article Links

It is important to remember the way these counts have been generated, as described above. They are counts of reference/citation links, not counts of articles, nor of journals *per se*. For example, a 1981 article published in *Journal of the American Chemical Society* may have had 40 references. These 40 references contained, let us say, citations of only 35 *different* articles. The 35 different cited articles appeared in 10 different journals. In other words, the 40 references cited some articles—at the most 5—more than once, and cited each of the ten different journals an average of 4 times. In compiling the *JCR*, it is the number of different article-to-article links that is counted. In this case the *Journal of the American Chemical Society* is credited with 35 unique references. Their 35 citations will be distributed among the 10 different cited journals, each receiving on the average a 'cited' count of 3.5—not 4, and not 1.

Lest this point be passed over as a laboring of the obvious, the user must remain aware that the *JCR* represents only one of several possible descriptions of journal relationships. Others have been suggested above, namely, one based on data including duplicate citation links between the same two articles, and another based on data including only *unique journal* links rather than unique article links between the same two articles.

#### The Ever-Changing River of Journals

Many users will need no reminder that the management of serials, among which are included scientific journals, is one of the thorniest thickets of bibliography and librarianship. Even knowledgeable estimates of the number of extant scientific and technical periodicals vary so widely—by tens of thousands—that the uninitiated cannot be blamed for doubting the competence of those concerned with the problem.

Like a real river, the river of scientific and technical publication is ever-changing. Its elements are complex, its course confusing, but overall the difficulties and problems of serials librarianship in science are a reflection of the strength and force of its river's progress. Journals die but are replaced by others; journals grow and split into sections (lettered or numbered or subtitled and resubtitled) or into new journals; journals may narrow their interest and merge with other journals under old or new titles; titles change to reflect a reorientation even when splitting and merging is avoided—a few words are

added, some dropped, the language of the title itself may change.

This characteristic but vital inconstancy of scientific publication is severely problematic for an effort like the *JCR*<sup>™</sup> that seeks to describe journal relationships over periods of time. There is, to be sure, the additional confusion contributed by incorrect or ambiguous citations, by the sometimes truly stultifying virtuosity of title abbreviators, by the 'separateness' of original and translated versions of the same journal, etc. As irritating and time-wasting as such things are, they are nevertheless of relatively minor significance within the total complex framework. Most are amenable to easy solution, given persistence, generous computer time, and the ability to survive seemingly endless deserts of boredom. (One very soon ceases to wonder at the reason behind some probably reasonable researcher's decision to abbreviate in yet another way the title of the *Comptes Rendus* of the French Academy of Sciences.)

#### When and When Not to Combine Citation Counts

The user is advised in any detailed chronological study to make use of the cross-references in the annually issued *SCI*<sup>®</sup> *Guide and Lists of Source Publications*, and to consult periodical directories that provide historical and genealogical information about serials, such as Ulrich's or CASSI.

Compilation of the *JCR* has, as thoroughly as possible, dealt with these 'minor' problems. Major problems of identification remain, however, and the user and researcher must not expect that they have been solved. Any general attempt to do so would have been misguided and inevitably abortive. We have, thus, in compiling the *JCR* refrained from combining journal counts on the basis of 'lineage,' even when it is clearly definable. Except where a title change has been so minor (usually among latter words) that it neither affects the title's position in a catalog listing nor requires additional or different entries, the *JCR* does not combine counts for related journals (replacements, supersedents, continuations, descendants, etc.). Nor does it combine counts for 'sections' of 'the same journal'. *JCR* leaves it to the user to decide whether or not his purpose

recommends that counts be combined in such cases.

A particularly well-known example of this problem is that of Soviet journals and their translations. To alert the user, an asterisk after a main entry or subentry abbreviation signals that citation counts for the original and translated versions have been kept separate. Unfortunately it would be impractical to attempt anything similar for the hundreds of journals that are lineally or otherwise related to others in these lists.

#### Caution!

Caution is advisable in comparing journals, especially journals from different disciplines. The journal literature varies in its importance as a means of disseminating information in different fields. Wide citation may be necessary practice in one field, but a redundancy in another discipline because of other means of dissemination. Citation practices differ from one field to another. The difference may be complicated by a difference in the half-life of journal literature in different fields, as well as the size of the extant citable literature. Rapid obsolescence may characterize one field but not another. Thus, for example, it would be foolish to conclude merely on the basis of citation counts that the *Journal of the American Chemical Society* is a 'better' journal than *Annals of Mathematics*, or to hypothesize, without a great deal of study, which serves its own field 'better.' To enable the *JCR* user to analyze more carefully these data within subject groupings, a breakdown of journals by subject categories with impact factors and half-life indicators is provided as Section 8 of the *Journal Ranking Package*.

Other factors must be considered as well. For example, journals that do not use the Roman alphabet are not as easily and economically included in the *SCI* data base as those that do. This fact may affect the ranking and citation counts of some Russian and Japanese journals. Or a journal may have published two or three articles that are cited year after year with extraordinary frequency, compared with the 'average' article it has published. Citations of such papers may distort evaluation of the journal unless their records are taken into account.