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How ISI Selects Journals for Coverage: Quantitative and Qualitative Considerations

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ISI® takes into account many factors when making journal coverage decisions. Three types of information are discussed and illustrated: citation data, journal standards, and expert judgment. The essay is based on a lecture presented at the Symposium on Science Journal Evaluation, the National Science Council of Taiwan, Science and Technology Information Center, Taipei, on March 21 and 22, 1990.

I recently had the pleasure of visiting Taipei, Taiwan, as a guest of the National Science Council. Our very gracious host, Tao-Hsing Ma, director of the Science and Technology Information Center, invited me to address two groups of journal editors, information specialists, and librarians and arranged an informative tour of the nation's leading research institutions. At the conclusion of our tour, we were charmed by Patzen Wu, executive secretary of the Council's Science and Technology advisory group.

The subject of my talk was one that frequently comes up at ISI®—journal selection. We receive a steady stream of calls and letters asking how ISI decides what journals are covered in various editions of *Current Contents*® (*CC*®), the *Science Citation Index*® (*SCI*®), and other services. Editors in particular are the most inquisitive—perhaps because they believe that coverage by ISI and other international secondary information services attracts greater notice to their journals.

ISI's journal selection considerations have often been discussed in *CC*.[1,2] The Taiwan presentation is the most recent update on this perennially popular topic, and I've adapted it in this essay for the benefit of interested readers. This overview will, to some extent, generalize and simplify what is actually a painstaking process of research, analysis, and consultation by a professional staff of subject specialists.

Three Broad Criteria

Basically, three types of information are taken into account when evaluating journals for coverage, ranging from the quantitative to the qualitative: citation data, journal standards, and expert judgment. ISI is unique among the world's leading information services for indexing all cited references as well as complete bibliographic information on all items published in a journal—not just articles and reviews but letters, editorials, errata and retractions, book reviews, and other items. ISI's consolidated database for the *SCI*, *Social Sciences Citation Index*®, and *Arts & Humanities Citation Index*® now includes about 18,000,000 source items published from 1945 until today in thousands of journals, and more than 217,000,000 cited references.

These citation data are a source of quantitative indicators that can be used to evaluate existing journals with established track records, as is discussed later. But selection of new journals often relies on other, more qualitative considerations. Journal standards are an example. A journal's ability to meet its declared schedule and frequency is perhaps the most basic expectation. Standards can also include editorial requirements for

abstracts, titles, and references set by professional associations of publishers and editors.[3,4] Peer review of submissions, editorial board membership, and the reputation of the publisher or sponsoring society are other indicators of journal quality.

Finally, journal selection also relies on the subjective judgment of experts in a particular field—subscribers, editors and publishers, and ISI's many editorial advisory board members and staff specialists.

Why Be Selective at All?

ISI's objective as a secondary information service is to provide comprehensive coverage of the world's most important journals for our subscribers' current awareness and information retrieval needs. But comprehensive does not necessarily mean all-inclusive. The success of *CC* is partly due to the fact that most of its readers already find more than they need in it. In fact, many readers feel ISI should do whatever possible to contain the proliferation of journals—not to encourage it.

Of course, this does not mean we urge publishers to limit the number of journals in the marketplace. As I've stated before, there is nothing we can or should do to prevent the legitimate "proliferation" or "twigging" of journals.[5,6] Curtis G. Benjamin, former president, McGraw-Hill Book Company, New York, coined the word "twigging" to describe the relentless specialization of scientific knowledge and, as a result, the burgeoning number of and markets for scientific publications.[7] But, as many critics have pointed out, the problem is that publishers sometimes launch journals prematurely before an adequate market develops.

The fact is, no matter how many journals are in the market, only a small fraction account for most of the articles that are published and cited in a given year. This is illustrated in Figure 1, which shows the distribution of journal articles and citations in the 1988 *SCI* database.

In a recent *New Scientist* "Forum" feature on scientific journals, British research chemist Susan Aldridge discussed the "80/20 rule" for time management—that is, that 80 percent of results come from doing 20 percent of the tasks.[8] While the rule is typically intended as a useful reminder to business executives who face mounds of paperwork, Aldridge suggested it applies as well to researchers trying to gain control over the flood of literature. She speculated that the *SCI* database would provide "a fine example of the 80/20 rule."

The graph shows that Aldridge's hunch is indeed true for citations but not for articles. The solid line indicates that 900 (21 percent) of the 4,400 journals indexed in the 1988 *SCI* received 83 percent of the 8,000,000 citations processed for the *Journal Citation Reports®* (*JCR®*) that year. But the dotted line shows that it took 2,000 journals (46 percent) to publish 86 percent of the 435,000 original research or review articles and technical notes included in the 1988 *JCR*.

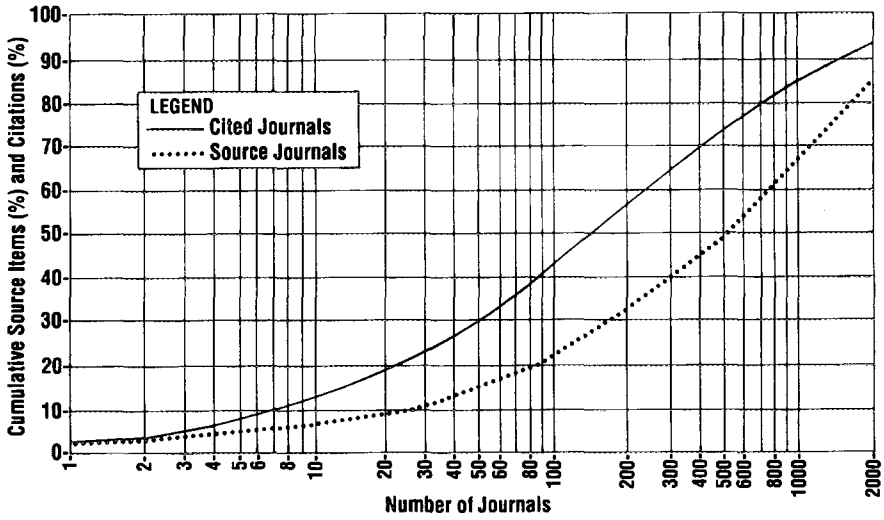
The graph, of course, is merely another illustration of the well-known Bradford and Zipf distributions and various other statistical patterns. The literature on these subjects is too voluminous to cite here but was reviewed previously.[9] Recently, a "Bibliometrics Toolbox" software package was created that can generate such graphs from the *SCI* and other data.[10]

These data illustrate the fact that ISI could conceivably limit itself to the top 500 journals and still provide comprehensive coverage of the most important publications. Thus, ISI's coverage of over 7,000 journals goes well beyond what the average subscriber needs or perhaps even wants to know about the research literature. In the past I have referred to this as Garfield's law of concentration.[11]

Citation Data for Journal Evaluation

Several types of journal citation data covering a particular year or period of time can be derived from the ISI database. Librarians, information researchers, editors, and others who regularly use ISI's *JCR* for evaluation and analysis already are familiar with most of these: total citations, impact, what a particular journal cites most frequently, what journals cite it, and so on.[12]

Figure 1: Distribution of published items and citations among science journals, 1988 *SCI*®.



It should always be stressed that citation data must be carefully interpreted—and their limitations clearly understood—when they are used for evaluating anything. This subject has been extensively and repeatedly discussed in *CC* and needs only brief mention here.[13-15] For example, the number of authors and journals varies greatly between and within disciplines, as do their citation levels and rates. Smaller fields like botany or mathematics do not generate as many articles or citations as, say, biotechnology or genetics. Also, in certain fields it may take 10 or more years for an article to attract a meaningful number of citations, while in other research areas citations can typically peak after only a few years. These points should be kept in mind as we consider the following examples.

Journal Rankings by Total Citations

The list of the 25 most-cited journals in the 1988 *SCI* (Table 1) probably agrees closely with most readers' mental list of the most important scientific journals. Hardly anyone would dispute the inclusion of the *Journal of Biological Chemistry*, *Nature*, the *Proceedings of the National Academy of Sciences of the USA*, the *Journal of the American Chemical Society*, *Science*, or any others. The same basic group of journals tends to be most cited year after year. A few may gradually decline or be replaced by successful newcomers like *Cell* as editors and audiences change. But most successful journals survive and prosper for decades.

Table 1: The 25 most-cited journals, 1988 *SCI*® *JCR*®.

Journal	1988 Citations
J. Biol. Chem.	172,726
Nature	167,897
Proc. Nat. Acad. Sci. USA	167,464
J. Amer. Chem. Soc.	122,492
Science	106,393
J. Chem. Phys.	84,098
Phys. Rev. Lett.	73,497
N. Engl. J. Med.	69,103
Phys. Rev. B—Condensed Matter	68,179
Lancet	67,723
Biochim. Biophys. Acta	65,593
J. Immunol.	64,358
Cell	63,776
Biochemistry—USA	52,123
Amer. J. Physiol.	50,108
Brain Res.	49,167
J. Clin. Invest.	46,243
Astrophys. J.	44,733
Biochem. J.	43,589
J. Cell Biol.	41,906
Cancer Res.	41,731
Biochem. Biophys. Res. Commun.	41,353
J. Exp. Med.	37,079
J. Org. Chem.	35,940
J. Phys. Chem.	34,856

Not surprisingly, the list is dominated by larger journals and the big life-sciences specialties. Fourteen also ranked among the top 25 by number of articles published. To compensate for this putative size advantage, a journal's impact—the average number of citations per article—can be considered rather than its total citations.

Journal Rankings by Impact

In Table 2 impact is calculated as follows: the number of articles published by a journal in 1986 and 1987 is divided into the number of citations they received in 1988. For example, the *Annual Review of Biochemistry* published 67 articles in 1986 and 1987. They received a total of 3,237 citations from ISI-covered journals in 1988. Thus, its impact factor is 48.3.

The list is obviously dominated by review journals, which tend to publish fewer contributions than original research journals, but these are cited much more frequently. Table 3 presents another impact ranking, showing only journals that published at least 100 articles, which effectively excludes most review journals.

Eighteen life-sciences journals are listed, compared to two each for chemistry and physics. Again, while impact compensates somewhat for the size of a journal or literature, it tends to favor research areas that more heavily cite recent research published in the last two years. As we found several years ago, the average number of references cited per article is perhaps the most significant contributing factor. This may or may not be a reflection of the field size.[16]

Table 2: The 25 highest impact journals, 1988 *SCI*® *JCR*®.

Journal	Impact	1986-1987 Articles	1988 Citations
Annu. Rev. Biochem.	48.3	67	3,237
Pharmacol. Rev.	29.4	17	500
Annu. Rev. Immunol.	25.4	49	1,245
Annu. Rev. Cell Biol.	24.2	33	799
Advan. Chem. Phys.	24.0	11	264
Cell	23.9	863	20,637
N. Engl. J. Med.	21.1	716	15,142
Advan. Cyclic Nucl. Prot.	18.2	6	109
Annu. Rev. Neurosci.	17.0	36	611
Advan. Prot. Chem.	16.5	4	66
Science	16.5	1,616	26,596
Advan. Immunol.	16.4	20	328
Microbiol. Rev.	16.3	49	797
Nature	15.8	2,375	37,425
Annu. Rev. Genet.	15.1	43	650
Rev. Mod. Phys.	15.1	47	711
Lancet	14.5	955	13,828
Annu. Rev. Plant Physiol.	13.4	39	521
Electroanal. Chem.	12.3	4	49
Physiol. Rev.	12.2	47	575
Advan. Nucl. Phys.	11.9	10	119
J. Exp. Med.	11.8	623	7,369
EMBO J.	10.9	1,055	11,538
Immunol. Today	10.7	164	1,747
Endocrine Rev.	10.6	54	570

Calculating the Impact of Journals Not Covered by ISI

There seems to be a widespread misconception that the *JCR* gives citation data only for those journals indexed in the ISI databases. In fact, any publication that is cited by ISI-covered journals will be included in the *JCR*'s ranking of journals by total citations received and in the cited journal listing. While data on the number and type of source items published is not provided for a nonsource journal, the number of times it was cited is shown.

This makes it possible to calculate impact factors of journals not included in ISI's databases. A simple and effective method for doing so was described in a recent letter in the *Journal of Documentation*, by B.K. Sen, A. Karanjai, and U.M. Munshi, Bibliometrics Section, INSDOC, New Delhi, India.[17] They manually counted the number of source items published by the *Indian Journal of Malariology* over a two-year period. They also recorded the number of times the journal cited itself and added these to the number of citations from *SCI*-covered

Table 3: The 25 highest impact journals publishing at least 100 articles, 1988 *SCI*® *JCR*®.

Journal	Impact	1986-1987 Articles	1988 Citations
Cell	23.9	863	20,637
N. Engl. J. Med.	21.1	716	15,142
Science	16.5	1,616	26,596
Nature	15.8	2,375	37,425
Lancet	14.5	955	13,828
J. Exp. Med.	11.8	623	7,369
EMBO J.	10.9	1,055	11,538
Immunol. Today	10.7	164	1,747
Chem. Rev.	10.4	100	1,040
Proc. Nat. Acad. Sci. USA	10.0	3,968	39,805
J. Cell Biol.	9.7	983	9,582
Trends Neurosci.	9.2	186	1,702
Ann. Intern. Med.	8.5	538	4,555
Phys. Rep.—Rev. Sect. Phys. Lett.	8.2	145	1,194
Phys. Rev. Lett.	8.2	3,022	24,821
Trends Biochem. Sci.	7.9	252	1,984
Mol. Cell. Biol.	7.7	1,187	9,170
J. Clin. Invest.	7.6	1,013	7,690
J. Immunol.	6.9	2,666	18,409
Arch. Gen. Psychiat.	6.8	251	1,708
Blood	6.8	1,087	7,445
Account. Chem. Res.	6.7	124	826
Circulation	6.7	994	6,636
J. Mol. Biol.	6.6	665	4,359
J. Biol. Chem.	6.5	5,335	34,632

Table 4: The top 25 journals by five-year impact that published at least 100 articles, 1984 *SCI*®. Citation data were taken from the 1984-1988 *SCI*.

Journal	Impact	1984 Articles	1984-1988 Citations
Cell	77.4	427	33,030
J. Exp. Med.	44.2	294	12,989
Proc. Nat. Acad. Sci. USA	38.5	1,681	64,777
EMBO J.	33.7	495	16,688
J. Clin. Invest.	31.1	487	15,130
Arch. Gen. Psychiat.	27.2	197	5,364
Nucl. Acid. Res.	26.7	723	19,333
J. Biol. Chem.	25.7	2,424	62,250
J. Neurosci.	26.7	293	7,815
Circ. Res.	25.4	172	4,375
Mol. Cell. Biol.	24.6	395	9,725
J. Immunol.	24.3	1,076	26,176
Mol. Pharmacol.	22.2	147	3,262
Nature	21.1	3,561	75,074
Phys. Rev. Lett.	20.9	1,445	30,201
Blood	20.6	444	9,156
J. Mol. Biol.	20.4	416	8,497
Science	19.7	2,091	41,107
Eur. J. Immunol.	19.3	211	4,074
Neuroscience	19.2	272	5,227
Gene	18.6	247	4,586
J. Clin. Endocrinol. Metab.	18.4	420	7,743
J. Comp. Neurol.	18.4	377	6,939
Nucl. Phys. B	18.2	576	10,504
J. Virol.	17.7	563	9,976

journals as listed in the *JCR*. By dividing self- and *SCI*-citations by source items, they were able to calculate impact. Also, S. Maričić, Association of Scientific Unions of Yugoslavia, Zagreb, and colleagues have used the same method for some 10 years.[18]

Sen *et al.* suggest that this method can be used by editors in Third World and Communist block countries to evaluate and, if necessary, improve the "quality" of their journals as well as to bring to ISI's attention journals that may be suitable for coverage. Many Third World editors have already asked us why their publication is not covered by ISI when its impact, although low, is comparable to other journals we do index. This reflects another common misconception—that impact factors are the sole or single most important criterion for coverage. In fact, journal impact is only one of several quantitative and qualitative factors described in this essay that we take into account.

Rankings by Five-Year Impact

Recently, ISI created a database that includes *five*-year impact factors, and the top 25 journals ranked by this measure are listed in Table 4. In these examples, impact is calculated by dividing the number of articles published by a journal in 1984 into the number of citations they received from 1984 through 1988. For example, *Cell*'s 427 1984 articles were cited 33,030 times from 1984 to 1988, giving an impact factor of 77.4.

Basically the same set of journals comes out on top in Tables 3 and 4 whether impact is calculated over two or five years. Fourteen journals appear on both lists, and both are dominated by life-sciences journals.

Item-by-Item Impact

ISI's database can also derive separate conventional two-year impact factors for the various types of "source items" published in a journal—articles, research reviews, let-

ters, notes, editorials, and errata and retractions. For example, in 1986 we studied 40 leading medical journals and compared these so-called "item-by-item" impacts.[19] Review articles had the highest impact in four of the top five journals—the *Annals of Internal Medicine*, *JAMA—Journal of the American Medical Association*, *Lancet*, and the *New England Journal of Medicine* (*NEJM*). Original research articles were the impact leader in the *British Medical Journal* (*BMJ*) and were second in *Lancet* and *NEJM*. Interestingly, either discussions or proceedings ranked second in impact for the *Annals*, *BMJ*, and *JAMA*.

This information demonstrates the diversity—in kind, number, and impact—of the types of items typically published in journals. The impact of letters, editorials, proceedings, and discussions argues in favor of comprehensive coverage of *all* items, as ISI provides, and against limiting coverage to articles and reviews only.

Tracking Journal *Citation Classics*®

The highest impact items ever published by a particular journal can also be identified in the ISI database. An example is shown in Table 5, which reproduces the first page of a 241-page printout on *Cell* that includes over 2,500 articles cited at least 50 times from 1945 through 1988. An abbreviated reference is given to keep the file within manageable limits.

The report ranks articles by total citations and details year-by-year citations to show how rapidly each item was cited, and whether its impact is rising, steady, or declining. These annual citation trends can also uncover possible cases of delayed recognition, which was illustrated in the first essay in our *CC* series on the most-cited papers ever.[20] Editors have used these files to prepare progress reports to boards of directors, support budget and funding proposals, compare performance against peers and competitors, and plan commemorative issues and for various other reasons, including simple curiosity and professional pride.

Internationality

The geographic representation of a journal is another consideration. Unless a journal of interest to only a small region of the world is exceptional in some way, we are less likely to cover it.

ISI's data can be used to indicate a journal's "internationality," in two senses: the nationality of items it publishes and the nationality of the articles that cite it. Table 6 shows the nationality of 1984 articles from the *International Journal of Cancer*, defined by the address of the *first* author. That is, if a US institution was listed, the article was

Table 5: The six *Cell* articles most cited in the 1945-1988 *SCI*®, first page of a 241-page printout on this journal from the ISI® Journal Classics file.

First Author				Year	Vol.		First Page	Journal Rank	Total Citations
BERK A J				1977	12		721	1	1,951
77=1	78=23	79=54	80=99	81=122	82=156	83=215	84=233	85=267	
86=260	87=267	88=254							
O'FARRELL P Z				1977	12		1133	2	1,940
77=0	78=16	79=65	80=124	81=170	82=181	83=226	84=201	85=232	
86=250	87=259	88=216							
REINHERZ E L				1980	19		821	3	1,429
80=12	81=97	82=182	83=252	84=222	85=203	86=184	87=146	88=131	
MANIATIS T				1978	15		687	4	1,374
78=1	79=30	80=120	81=174	82=153	83=188	84=174	85=163	86=128	
87=125	88=118								
KELLY K				1983	35		603	5	1,147
83=0	84=92	85=214	86=267	87=314	88=260				
GILMAN A G				1984	36		577	6	1,051
84=17	85=136	86=262	87=364	88=272					

credited to the US even though the author may be a visiting researcher from the UK, France, or India, or the coauthors may be based in other countries. The number of such international collaborations is small, however, typically accounting for less than 5 percent of all *SCI*-indexed source items per year.

Of the 251 articles published by this journal in 1984, 60, or 24 percent, were from the US. The UK is second with 29 articles (12 percent), followed by Japan with 22, France (20), and Italy (19). In total, 32 nations were represented by the first authors of 1984 articles in the *International Journal of Cancer*, and the top five countries identified above accounted for 60 percent.

Table 7 shows the nationality of the 1984-1988 articles that cited this journal's 1984 publications at least 20 times. Again, US articles top the list with 1,091 citations, or 31 percent of all citations received by the *International Journal of Cancer*. Japan is second with 399 citations (11 percent), followed by the UK (360, 10 percent), Italy (226, 6 percent), and France (223, 6 percent).

All of these examples show that citation data can provide a wide range of information on journals. As stated at the outset, citation data are one category of information ISI considers in evaluating journals for coverage. Another key consideration is a set of basic journal standards.

Basic Journal Standards: Timeliness Above All

One of the most basic obligations a journal owes its subscribers is timeliness or regularity. It is unethical and unacceptable for publishers to allow journals to appear chronically late, weeks or months after their cover date. Of course, temporary production problems or other factors may sometimes cause journals to be delayed. But if the journal cannot maintain or manage an adequate backlog of manuscripts, the publisher should merge it or throw in the towel. And if a publisher is unresponsive, then subscribers should refuse to accept false publication dates and other rip-offs.[21]

Whether or not a journal follows international editorial conventions may also influence ISI's decision to cover it. ISI has advocated a variety of editorial practices and standards that apply equally to established and new journals. More informative jour-

Table 6: The nationality of first authors of articles published in the *International Journal of Cancer*, ranked by total 1984 articles and showing total 1984-1988 *SCI*® citations and five-year impact factors. Only those nations with at least five articles are listed.

Country	1984 Items	1984-1988 Citations	Five-Year Impact
US	60	707	11.8
UK	29	398	13.7
Japan	22	474	21.6
France	20	260	13.0
Italy	19	324	17.1
Sweden	13	160	12.3
Israel	11	110	10.0
Canada	10	78	7.8
FRG	9	120	13.3
Australia	6	38	6.3
The Netherlands	6	168	28.0
Norway	5	94	18.8
Switzerland	5	126	25.2
All Others (19)	36	453	12.6
TOTAL	251	3,510	14.0

Table 7: The nationality of first authors of 1984-1988 *SCI*® papers that cited 1984 items in the *International Journal of Cancer*. Only those nations with at least 20 citations are listed.

Citing Country	1984-1988 Citations
US	1,091
Japan	399
UK	360
Italy	226
France	223
FRG	182
Sweden	132
The Netherlands	128
Canada	116
Australia	74
Switzerland	55
Norway	54
Israel	52
Belgium	49
Finland	49
Denmark	47
Austria	46
USSR	39
South Africa	30
Czechoslovakia	20
All Others (25)	138
TOTAL	3,510

nal titles, fully descriptive article titles and abstracts, complete bibliographic information for all cited references, full addresses including telephone and fax numbers for every author of all published items, and contents page formats are several examples.[4,22,23]

Editorial policy on language is another consideration. We do cover a large number of foreign-language journals, but the presence of informative abstracts or summaries in English is essential. If editors truly want wider notice of their journals by the international research community, they ought to publish article titles, abstracts, and cited references in English. If its English title and abstract seem especially interesting, more scientists might be encouraged to go to the trouble of reading the foreign-language article.

Other indicators of quality are also important—such as whether a journal relies on peer review to assess the relevance of a submitted manuscript, the reliability of its methods, the originality of findings, the completeness of references, and other factors.[24]

We also look at the recent track record, that is, the previously published works of the editorial board members and contributing authors. For example, we examine how often they have published; in which journals their articles appear; and if their works have been cited. We also check their reference lists to make sure the authors are citing a broad range of important journals. This ensures that the authors have consulted the literature and are members of a broad scientific community.

The reputation of a particular publisher or professional society is some help in evaluating new journals. Of course, a good track record on old journals does not necessarily guarantee the performance of new journals. Publishers have been known to launch journals prematurely, often at the prodding of special-interest groups. Also, some government-sponsored or professional dues-subsidized journals may occasionally be adversely affected by annual fluctuations in budgets and membership renewals.

By considering a combination of citation data and these basic editorial standards, it is possible to make an informed journal-coverage decision in most cases. However, ISI does rely also on the subjective judgment of experts in the field.

Expert Judgment

Since its beginning in the early 1960s, ISI has benefited from the expert consultations provided by the editorial advisory boards for our various products and services. The members are distinguished researchers whose collective multidisciplinary expertise gives ISI valuable input about important new and existing publications.

For many new journals, we also solicit critiques from people working in the disciplines covered by the journals. Of course, this has its drawbacks. If a new journal covers a specialized topic, the experts in that field are probably the most likely to put the highest value on greater coverage of that topic. This self-interest is weighed when we evaluate critiques and recommendations solicited from outside experts.

Of course, ISI's staff of subject specialists also considers the invited and uninvited advice of subscribers, editors, publishers, and others about journals we ought to cover or not drop. ISI welcomes all informed opinions about the value of a particular new or established journal. In fact, we are planning a new large-scale survey of ISI subscribers later this year that will give us essential feedback on journal coverage.

How to Recommend Journals

As was stated at the outset, we get many letters and calls suggesting various journals as candidates for coverage by ISI. As a helpful reminder, we request that all nominations be accompanied by one or more *recent* copies of the journal. It is essential to provide us with the editor's full name and complete address, including telephone and fax numbers. We also request that you specify

the publisher, language, publication frequency, and other basic information.

In conclusion, I'd like to reiterate that journal selection is a painstaking process at ISI performed by staff specialists. It involves a combination of citation analysis, research on timeliness, reliability, and other standards, and the judgment of outside experts in the field. Our goal is to provide comprehensive coverage of the most important journals for our subscribers. By basing our selection decisions on a thorough and balanced analysis of several factors, ISI will continue to meet its subscribers' expectations for high quality current awareness and information retrieval services.

* * * * *

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