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Chapter Nine

Citation Analysis of Scientific Journals

Citation analysis is used to study the journals of science as well as the people and work of science. The citation links between scientific papers, technical notes, reviews, and, in some cases, meeting abstracts provide a quantitative picture of journal utility and relationships that is useful in many ways. For example, it may be used by editors trying to determine their competitive position, information scientists studying the structure of the literature, librarians managing journal collections, sociologists attempting to define the structure of science itself, and every researcher who has a need to identify useful journals when the interaction between specialties or disciplines pushes him or her beyond the borders of familiar territory.

The citation picture of journals is subject to the same qualifications as all other citation pictures. Based only on what scientists say about utility and relationships in their choice of references, it is not definitive. For one thing, citation links show only how frequently and where published research is used. How good a measure that is of a journal's utility and relationships varies according to the function of the journal. For those whose primary function is to keep scientists informed about what is going on in a general news sense, and that publish few research reports or reviews, it is a measure of little, if any, relevance. On the other hand, citation links provide a very relevant measure of the utility and relationships of journals whose primary function is to communicate research results. Even in these cases, however, the citation picture is not a definitive one, simply because scientific merit is not always the sole reason an author will cite a paper published in a particular journal. Such factors as the reputation of the cited author and the visibility, prestige, and accessibility of the cited journal may affect, to a greater or lesser degree, the work an author chooses to cite. Because of these qualifications, citation pictures of journals have to be used with the same care and intelligence as any other type of citation picture: they must be applied only where they are relevant, and they must be interpreted within the framework of the decision to be made or the hypothesis to be examined.

A CITATION VIEW OF JOURNALS

The preceding qualifications notwithstanding, citation analysis provides a number of interesting and useful insights into the network of journals that function as the primary, formal communications medium of science. The insights come from five different citation measures.

The basic one is the citation rate of a journal: the number of times it has been cited. There are several different ways this figure can be calculated. It can consist of all the references to the cited journal, with even duplicate references from the same source article counting as separate citation links. At the other extreme, the citation rate of a journal can consist of only the number of source articles that cited the journal, with multiple references (even different ones) from the same source article counting only as a single citation link. Somewhere between these two extremes lies a third type of citation rate that consists of the number of references to the cited journal, but that discounts duplicate references from the same source article, so they count as only a single citation link. The third type of citation rate is the one used at ISI.

Another citation measure is the impact factor, which is the average citation rate of a journal's articles. The purpose of the impact factor is to discount the advantage in citation potential that larger/older journals have over smaller/younger journals because they publish more material. Again, there are several different ways of calculating the impact-factor measure, which is basically a ratio between the citation rate of the journal and its citation potential. The difference between the various ways lies in the way these two parameters are defined. Citation rate can consist of either the number of times cited or the number of items cited. The citation potential can consist of either the number of citable items published or the number of cited items published. At ISI, citation rate is defined as the number of times cited, while citation potential is defined as the number of citable items published. The impact factor we use, therefore, is the number of times a journal was cited, divided by the number of citable articles the journal published.

There also are two measures of how frequently journals cite themselves. One is the self-citing rate, which shows what percentage of a journal's references cite articles it published. The other is the self-cited rate, which shows what percent of citations received by a journal originated in articles published by the journal.

It is hard to say anything very definitive about these two measures because their analytical role has not been worked out. They are being used primarily in studies to determine the significance of self-citation practices. Some observers look upon self-citation as a self-serving practice, particularly when authors cite their own work. On the other hand, it is easy to justify the practice as being nothing more than a manifestation of the perfectly normal tendency of a scientist to build on his or her own work. Certainly, the practice is common; although precise figures are difficult to develop, it would be safe to say that some 10 to 20% of all references cite prior work of the source author. The significance of self-citations at the journal level also is uncertain. Preliminary studies at ISI (1) show that among the top 20 most cited

journals, the self-cited rate was generally lower than the self-citing rate. This means that the references these journals published to their own articles were a smaller percentage of the citations they received than they were of the references they published. However, when the focus of the study was switched to the group of journals that ranked from 500 to 520 in terms of citation rate, the reverse was found to be true: their self-cited rate tended to be higher than the self-citing rate. The reason for this reversal is not yet clear, but self-citation rates seem to say something about the newness, size, and isolation of the intellectual universe in which a journal operates.

The fifth citation measure is an immediacy index, which is a way of showing how rapidly a journal's material is picked up and used. This measure, too, can be calculated in several different ways, but the basic parameter used in all of them is the number of citations received by articles during the year in which they were published. This parameter can be shown either as a percent of the total number of citations received (citation rate) or as a percent of the total number of citeable articles published (citation potential). ISI's immediacy index consists of the latter.

DATA BASE OF JOURNAL CITATION MEASURES

All five of these measures are published in the *Journal Citation Reports* (*JCR*™*) section of *SCI* for the thousands of cited and source journals covered by the index (2). The first issue of *JCR* was published in the 1975 *SCI* but reflected the 1974 citation record of the journals covered. The record was based on 4,248,065 citations from the references of approximately 400,000 source items published in the 1974 issues of some 2400 source journals. The references provided citation data on more than 2500 cited journals.

The citation data for these journals is organized into three separate, but related, packages. The first is the Journal Ranking Package, which consists of six sections. Section I (see Figure 9.1) is an alphabetic listing, by title abbreviation, of 2630 cited journals for which it shows:

- The total number of times cited (citation rate).
- The number of citations to articles published in 1972 and 1973 (by individual year and in aggregate).
- The number of items published (citation potential) in 1972 and 1973 (by individual year and in aggregate).
- The impact factor.
- The number of citations to articles published in 1974.
- The number of items published in 1974.
- The immediacy index.

The entry for *Acta Anaesthetica Scandinavica* in Figure 9.1, then, shows that references cited it 287 times; 25 of those references cited articles published in 1973

*A trademark of the Institute for Scientific Information.

Specimen

JOURNAL RANKING PACKAGE — J O U R N A L C I T A T I O N R E P O R T S — SECTION 1 PAGE 1

JOURNALS IN ALPHABETICAL ORDER

	JOURNAL TITLE	<--CITATIONS IN 1974 TO--> ALL YEARS	1973	1972	73+72	<--SOURCE ITEMS IN--> 1973	1972	73+72	IMPACT FACTOR	CITATIONS IN 1974 TO 1974 ITEMS	SOURCE ITEMS IN 1974	IMMEDIACY INDEX
1	A GRAEFES A KLIN E O	647	72	52	124	90	78	168	0 738	24	123	0 195
2	A VAN LEEUW J MICROB	557	47	53	100	62	55	117	0 855	15	63	0 238
3	AAPG BULL	1639	151	203	354	145	158	303	1 168	29	161	0 180
4	ABRASIVE ENG	1	0	0	0	25	35	60	0 000	0	24	0 000
5	ACCOUNTS CHEM RES	2738	326	555	881	63	56	119	7 403	65	62	1 048
6	ACTA AGRON HUNG	43	6	2	8	54	60	114	0 070	1	93	0 011
7	ACTA ALLERGOL	334	40	44	84	33	39	72	1 167	9	40	0 225
8	ACTA ANAESTH SCAND	287	25	37	62	54	48	102	0 608	8	61	0 131
9	ACTA ANAT	1212	47	84	131	141	142	283	0 463	17	157	0 108
10	ACTA ASTRONAUTICA	10	0	0	0	40	89	129	0 000	3	94	0 032
11	ACTA BIOCHIM BIOPHYS	250	15	51	66	32	51	83	0 795	7	46	0 152
12	ACTA BIOCHIM POL	336	34	31	65	37	37	74	0 878	11	51	0 216
13	ACTA BIOL CRACOV BOT	48	2	5	7	13	19	32	0 219	1	15	0 067
14	ACTA BIOL CRACOV ZOO	66	5	2	7	27	23	50	0 140	1	18	0 056
15	ACTA BIOL HUNG	227	4	15	19	27	43	70	0 271	1	15	0 067
16	ACTA BIOL MED GER	922	112	189	301	216	228	444	0 678	50	223	0 224
17	ACTA BOT NEER	465	45	43	88	76	76	152	0 579	16	64	0 250
18	ACTA CHEM SCAND	8803	472	720	1192	549	595	1144	1 042	165	434	0 380
19	ACTA CHIM HUNG	904	98	97	195	197	236	433	0 450	29	152	0 191
20	ACTA CHIR HUNG	54	6	9	15	45	32	77	0 195	3	33	0 091
21	ACTA CHIR SCAND	1645	64	142	206	142	137	279	0 738	26	133	0 195
22	ACTA CIENT VENEZ	64	6	14	20	77	101	178	0 112	0	10	0 000
23	ACTA CRYSTALLOGR	7598	22	18	40	0	0	0		3	0	
24	ACTA CRYSTALLOGR A	1793	241	275	516	141	235	376	1 372	73	166	0 440
25	ACTA CRYSTALLOGR B	4520	854	984	1838	630	753	1383	1 329	221	635	0 348
26	ACTA CYTOL	763	98	93	191	81	90	171	1 117	8	73	0 110
27	ACTA DERMAT-VENEREOL	840	96	122	218	120	84	204	1 069	27	96	0 281
28	ACTA DIABETOL LAT	281	12	44	56	46	11	57	0 982	3	39	0 077
29	ACTA ENDOCRINOL PAN	12	0	6	6	8	10	18	0 333	0		
30	ACTA ENDOCRINOL-COP	4909	708	675	1383	251	311	562	2 461	159	278	0 572
31	ACTA ENTOMOL BOHEMOS	79	15	23	38	51	42	93	0 409	7	44	0 159
32	ACTA GENET MED GEMEL	122	1	5	6	13	33	46	0 130	0	61	0 000
33	ACTA GERONTOL	17	11	3	14	25	19	44	0 318	0	0	
34	ACTA HAEMATOL	953	54	111	165	88	100	188	0 878	16	93	0 172
35	[illegible]PATO-GASTRO		25			69			0 418		66	0

Figure 9.1 *Journal Citation Reports (JCR)* Journal Ranking Package, Section 1.

and 37 cited 1972 material, for a total of 62 references to the material published during that two-year period. It published 54 items in 1973, 48 in 1972, and a total of 102 during those two years; its impact factor is 0.608 (62/102); it published 61 articles in 1974 and they were cited eight times to produce an immediacy index value of 0.131 (8/61).

The other five sections of the Journal Ranking Package show all the same data, but the journals are listed in ranked order by the measures of citation rate (Figure 9.2), impact factor (Figure 9.3), immediacy index (Figure 9.4), items published in 1974 (Figure 9.5), and number of times 1972–1973 material was cited (Figure 9.6).

Specimen

JOURNAL CITATION REPORTS

	JOURNAL TITLE	<------CITATIONS IN 1974 TO------> ALL YEARS	1973	1972	73+72	<--SOURCE ITEMS IN--> 1973	1972	73+72	IMPACT FACTOR	CITATIONS IN 1974 TO 1974 ITEMS	SOURCE ITEMS IN 1974	IMMEDIACY INDEX
Section 2												
1	J AM CHEM SOC	98995	7855	9233	17088	1776	2123	3899	4 383	1835	1432	1 281
2	J BIOL CHEM	81354	6319	7366	13685	1213	1129	2342	5 843	1352	1147	1 179
3	J CHEM PHYS	62041	4496	5966	10462	1725	1860	3585	2 918	1022	1631	0 627
4	NATURE	59206	4016	3979	7995	1222	777	2199	3 636	1404	1962	0 716
5	BIOCHIM BIOPHYS ACTA	51491	6409	7720	14129	2314	2215	4529	3 120	946	1910	0 495
6	PHYS REV	50828	63	78	141	0	0	0		25	0	
7	SCIENCE	47505	5121	6660	11781	1026	1151	2177	5 412	1208	919	1 314
8	P NAT ACAD SCI USA	46917	6866	8451	15317	849	855	1704	8 989	1268	1195	1 061

Figure 9.2 *Journal Citation Reports (JCR)* Journal Ranking Package, Section 2. Ranking by total citation rate.

Specimen

JOURNAL CITATION REPORTS

	JOURNAL TITLE	<------CITATIONS IN 1974 TO------> ALL YEARS	1973	1972	73+72	<--SOURCE ITEMS IN--> 1973	1972	73+72	IMPACT FACTOR	CITATIONS IN 1974 TO 1974 ITEMS	SOURCE ITEMS IN 1974	IMMEDIACY INDEX
Section 3												
41	TOPICS STEREOCHEM	296	17	7	24	4	0	4	6 000	4	4	1 500
42	J BIOL CHEM	81354	6319	7366	13685	1213	1129	2342	5 843	1352	1147	1 179
43	ANNU REV BIOPHYS BIO	178	33	139	172	11	19	30	5 733	6	14	0 429
44	CHEM SOC REV	270	126	130	256	20	25	45	5 689	11	21	0 524
45	INT REV CYTOL	1236	74	135	209	21	17	38	5 500	15	30	0 500
45	ORG REACT	164	3	41	44	4	4	8	5 500	0	2	0 000
47	ADV CELL MOL BIOL	94	0	49	49	0	9	9	5 444	0	5	0 000
48	SCIENCE	47505	5121	6660	11781	1026	1151	2177	5 412	1208	919	1 314
49	GASTROENTEROLOGY	8693	1030	1230	2260	198	221	419	5 394	191	240	0 796
50	ORGANOMET CHEM REV A	226	0	53	53	0	10	10	5 300	0	0	

Figure 9.3 *Journal Citation Reports (JCR)* Journal Ranking Package, Section 3. Ranking by impact factor.

Specimen

JOURNAL CITATION REPORTS

	JOURNAL TITLE	<------CITATIONS IN 1974 TO------> ALL YEARS	1973	1972	73+72	<--SOURCE ITEMS IN--> 1973	1972	73+72	IMPACT FACTOR	CITATIONS IN 1974 TO 1974 ITEMS	SOURCE ITEMS IN 1974	IMMEDIACY INDEX
Section 4												
19	ADV COLLOID INTERFAC	113	0	25	25	0	5	5	5 000	7	5	1 400
20	J EXP MED	20699	2203	3354	5557	245	223	468	11 874	347	257	1 350
21	PHYSIOL REV	3996	227	272	499	18	18	36	13 861	25	19	1 316
22	SCIENCE	47505	5121	6660	11781	1026	1151	2177	5 412	1208	919	1 314
23	BELL SYST TECH J	2521	168	145	313	95	106	201	1 557	122	93	1 312
24	ADV ORGANOMETAL CHEM	408	66	26	92	8	7	15	6 133	9	7	1 286
25	J AM CHEM SOC	98995	7855	9233	17088	1776	2123	3899	4 383	1835	1432	1 281

Figure 9.4 *Journal Citation Reports (JCR)* Journal Ranking Package, Section 4. Ranking by immediacy index.

Specimen

JOURNAL CITATION REPORTS

	JOURNAL TITLE	<------CITATIONS IN 1974 TO------> ALL YEARS	1973	1972	73+72	<--SOURCE ITEMS IN--> 1973	1972	73+72	IMPACT FACTOR	CITATIONS IN 1974 TO 1974 ITEMS	SOURCE ITEMS IN 1974	IMMEDIACY INDEX
Section 5												
24	J APPL PHYS	19277	1509	1766	3275	1077	1025	2102	1 550	371	936	0 388
25	J CHEM SOC CHEM COMM	14454	1856	2597	4453	894	1231	2125	2 096	353	938	0 376
26	PHYS REV D	9441	2932	2372	5304	1033	915	1948	2 723	802	933	0 860
27	FIZ TVERD TELA	4497	499	562	1061	936	885	1821	0 583	114	919	0 124
(28)	SCIENCE	47505	5121	6660	11781	1026	1151	2177	5 412	1208	919	1 314
29	SOV PHYS SOLID ST*	2377	143	227	370	936	427	1363	0 271	12	919	0 013
30	CHEM PHYS LETT	8478	1899	2306	4205	928	822	1750	2 403	423	896	0 472
31	BRAIN RES-AMSTERDAM	10227	2012	2510	4522	775	682	1457	3 104	565	893	0 633

Figure 9.5 *Journal Citation Reports (JCR)* Journal Ranking Package, Section 5. Ranking by items published in 1974.

Specimen

JOURNAL CITATION REPORTS

	JOURNAL TITLE	<------CITATIONS IN 1974 TO------> ALL YEARS	1973	1972	73+72	<--SOURCE ITEMS IN--> 1973	1972	73+72	IMPACT FACTOR	CITATIONS IN 1974 TO 1974 ITEMS	SOURCE ITEMS IN 1974	IMMEDIACY INDEX
Section 6												
1	J AM CHEM SOC	98995	7855	9233	17088	1776	2123	3899	4 383	1835	1432	1 281
2	P NAT ACAD SCI USA	46917	6866	8451	15317	849	855	1704	8 989	1268	1195	1 061
3	BIOCHIM BIOPHYS ACTA	51491	6409	7720	14129	2314	2215	4529	3 120	946	1910	0 495
4	J BIOL CHEM	81354	6319	7366	13685	1213	1129	2342	5 843	1352	1147	1 179
(5)	SCIENCE	47505	5121	6660	11781	1026	1151	2177	5 412	1208	919	1 314
6	J CHEM PHYS	62041	4496	5966	10462	1725	1860	3585	2 918	1022	1631	0 627
7	LANCET	37047	5249	5134	10383	646	909	1555	6 677	1971	623	3 164
8	PHYS REV LETT	29275	5167	4941	10108	899	1099	1998	5 059	1416	960	1 475

Figure 9.6 *Journal Citation Reports (JCR)* Journal Ranking Package, Section 6. Ranking by citation rate of 1972-1973 material.

The other two packages are designed to show the relationships between journals as defined by citation patterns. One, the Citing Journal Package, shows the citation patterns of the 2443 source journals covered by *SCI* in 1974: what journals they cited, and with what frequency. The other, the Cited Journal Package, shows the sources of the citations to the 2630 cited journals identified by *SCI* in 1974 and the citation frequency of each source. Both packages also show a distribution of the citations by the publication year of the cited material.

Figure 9.7 shows a sample of the Citing Journal Package. The citing journals are listed in alphabetical order by title abbreviation. The first column shows the journal's impact factor; the second, an abbreviation of its title; and the third, the total number of references it published in its 1974 material. The remaining columns show how these references were distributed by the publication year of the cited material. The journals cited by a given journal are listed beneath it in the same column format: the first showing their impact factor, the second showing their title abbreviation, the third showing the total number of times they were cited, and the rest showing how the references were distributed by the publication year of the cited material. The references of a citing journal, therefore, are distributed by both the journals cited and the publication year of the cited material. The cited journals are listed in descending order of citation frequency, with the last entry consisting of the aggregate total of all journals that were cited fewer than six times. Since one of the cited journals is always the source journal itself (more often than not, it heads the list), the self-citing rate of the source journal can be computed by dividing the

number of references to its own material by the total number of references it published.

The entry for *Mathematische Zeitschrift* in Figure 9.7, then shows that:

- It published 1090 references (not including duplicate references from the same source article) in 1974, 26 of which cited 1974 material, 92 of which cited 1973 material, 115 of which cited 1972 material, and so on, with 432 of the references citing material published in 1964 or earlier.
- It cited itself more than any other journal, a total of 151 times.
- The 151 references to its own material were distributed as shown, with five citing 1974 material, 24 citing 1973 material, 18 citing 1972 material, etc., and with 36 citing material it published in 1964 or earlier.
- Of the other journals cited, it cited *Mathematische Annalen* the most frequently: 60 times. Four of the 60 references cited 1974 material, two cited 1973 material, and so on, with more than half of the 60 references citing material published in 1964 or earlier.
- Three hundred fifty-six of its references cited material published by 217 journals that are not identified. These references are distributed by the publication year of the cited material as shown: five to 1974 material, 28 to 1973 material, and so on, with 150 to material published in 1964 or earlier.

What the data in the entry for *Mathematische Zeitschrift* says about the journal is that approximately 40% of its references cited material published in 1964 and earlier (432/1090), that 42.6% of its references cited material published in 1969 or later (464/1090), that its self-citing rate is 13.8% (151/1090), that language presents no barriers to its authors (they cite English, French, German, Russian, and Japanese journals), and that the material it publishes is oriented toward physical and applied mathematics.

Figure 9.8 shows a sample of the Cited Journal Package. The format is the same as that in the Citing Journal Package, though the data and journals describe the number and source of citations received, rather than references published. The cited journals are listed alphabetically by title abbreviation, with the impact factor shown in the column preceding the title and the total number of times cited shown in the column following the title. The rest of the columns distribute the citations received by the publication year of the cited material. The journals that were the sources of the citations are listed beneath each cited journal, along with their impact factor and the number of times they cited it. The source references are distributed by publication year of the cited material. Again, the citations received by a journal are distributed by both their sources and the publication year of the cited material. And the source journals are again listed in descending order of citation frequency, with the last entry consisting of the aggregate total of a group of unidentified journals that were each responsible for fewer than six citations. Since every journal is cited by itself, every cited journal is also listed as one of its own source journals, making it possible to compute its self-cited rate by dividing the number of times it cited itself as a source journal by the number of times it was cited.

The entry in Figure 9.8 for the *American Journal of Physics,* then, shows that:

It was cited 800 times in 1974, with 14 of the references citing material published

Specimen

JOURNAL CITATION REPORTS

CITING JOURNAL PACKAGE

	CITING JOURNAL / CITED JOURNAL	TOTAL	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	REST
		<-NUMBER OF TIMES THIS YEAR WAS CITED IN 1974->											
17	MATH NACHR (CONTINUED)												
	ALL OTHER (313)	478	8	17	46	57	35	34	21	22	30	20	188
23	MATH SCAND	215*	1	14	30	15	17	14	12	8	14	4	86
23	MATH SCAND	16	0	3	4	0	0	1	0	0	1	1	6
1 22	ANN MATH	13	0	0	1	1	2	1	0	0	1	0	7
2 08	ACTA MATH	8	0	1	1	0	1	0	2	0	0	0	3
29	ARK MAT	7	0	0	0	1	1	0	0	1	0	0	4
51	B AM MATH SOC	7	0	1	0	0	0	0	0	1	0	0	5
48	T AM MATH SOC	6	0	0	0	0	1	0	0	0	2	0	3
	ALL OTHER (90)	158	1	9	24	13	12	12	10	6	10	3	58
47	MATH Z	1090*	26	92	115	95	70	66	61	49	41	43	432
47	MATH Z	151	5	24	18	12	19	6	9	9	6	7	36
38	MATH ANN	60	4	2	0	3	5	1	7	1	1	2	34
48	T AM MATH SOC	46	1	3	1	3	2	6	2	1	2	4	21
77	J ALGEBRA	40	0	3	10	7	1	5	5	1	4	0	4
1 22	ANN MATH	37	0	1	2	0	1	3	2	1	0	0	27
30	P AM MATH SOC	29	0	1	7	5	0	4	0	1	0	1	10
77	ARCH RATION MECH AN	25	0	3	3	4	1	3	4	0	2	1	4
47	AM J MATH	24	0	0	1	1	0	2	0	1	1	0	18
51	B AM MATH SOC	23	0	3	4	2	0	1	0	3	0	2	8
59	COMMUN PUR APPL MATH	19	0	3	3	1	1	4	0	0	0	0	7
31	J LOND MATH SOC	19	0	3	4	2	0	1	0	0	0	2	7
33	COMMENT MATH HELV	18	0	0	3	0	0	1	0	1	0	1	12
27	PAC J MATH	18	0	2	0	1	1	2	0	0	2	2	8
31	CAN J MATH	17	1	1	3	0	2	3	1	1	0	1	4
22	ARCH MATH	16	0	3	2	0	1	2	2	0	1	0	5
31	ILLINOIS J MATH	16	0	0	1	0	2	1	0	1	0	2	9
80	INVENT MATH	14	1	0	0	3	2	0	2	4	2	0	0
2 08	ACTA MATH	13	0	0	0	1	0	0	2	1	1	0	8
	ABH MATH SEM HAMBURG	12	1	0	0	0	0	0	1	2	0	0	8
	CR HEBD ACAD SCI	12	1	1	2	0	0	0	0	0	0	1	7
	FUND MATHEMATICAE	11	1	0	1	1	0	1	1	0	0	0	6
35	J REINE ANGEW MATH	11	1	0	1	0	0	0	1	0	0	0	8
53	P LOND MATH SOC	11	0	2	0	0	3	1	0	0	1	1	3
39	DUKE MATH J	10	1	0	1	0	1	0	0	0	0	0	7
	INDAGATIONES MATH	9	0	2	0	2	0	0	0	0	0	1	4
	J COMB THEORY	8	0	1	1	0	2	1	0	2	1	0	0
34	MANUSCRIPTA MATH	8	3	4	1	0	0	0	0	0	0	0	0
	J DIFFERENTIAL GEOM	7	0	0	0	2	1	1	2	1	0	0	0
49	STUD MATH	7	0	0	0	0	0	0	1	0	3	0	3
	TOPOLOGY	7	0	0	0	1	0	1	1	0	1	1	2
36	ANN I FOURIER	6	0	2	0	0	0	0	0	0	3	0	1
25	B SOC MATH FR	6	0	0	1	0	0	0	2	0	0	0	3
	J FUNCT ANAL	6	0	0	3	1	0	0	2	0	0	0	0
30	J MATH SOC JAPAN	6	1	0	0	1	0	0	1	0	1	0	2
	MAT SB	6	0	0	0	0	0	0	0	0	0	0	6
	SOV MATH DOKLADY	6	0	0	2	1	1	1	1	0	0	0	0
	ALL OTHER (217)	356	5	28	40	41	24	15	12	18	9	14	150

Figure 9.7 *Journal Citation Reports (JCR)* Citing Journal Package.

Specimen

JOURNAL CITATION REPORTS

CITED JOURNAL PACKAGE

	CITED JOURNAL / CITING JOURNAL	TOTAL	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	REST
	AM J PHARM EDUC (CONTINUED)												
	26 J AM PHARM ASSOC	2	0	0	0	0	2	0	0	0	0	0	0
	67 PHARMAZIE	2	0	0	1	0	1	0	0	0	0	0	0
	ALL OTHER (10)	10	0	1	3	1	2	0	2	0	1	0	0
25	AM J PHYS	800*	14	95	104	83	77	61	46	40	31	19	230
	25 AM J PHYS	243	7	60	44	34	14	10	17	5	10	8	34
	2 91 J CHEM PHYS	29	0	1	4	2	5	3	3	2	1	0	8
	99 NUOVO CIMENTO	26	0	2	6	0	5	1	0	1	2	1	8
	2 86 PHYS REV B	25	0	0	1	4	5	2	3	2	0	0	8
	2 61 PHYS REV A	21	1	0	6	1	7	0	0	2	1	0	3
	75 LETT NUOVO CIMENTO	18	0	2	2	2	1	1	0	1	1	0	8
	2 72 PHYS REV D	17	0	2	3	1	0	1	0	0	0	0	10
	53 FOUND PHYS	14	0	1	5	2	0	0	0	0	0	0	6
	1 55 J APPL PHYS	14	0	1	0	4	1	4	1	1	0	0	2
	1 04 J MATH PHYS	13	0	0	2	3	4	0	0	0	1	1	2
	2 01 J OPT SOC AM	12	1	0	1	3	0	2	1	0	0	0	4
	96 PHYSICA	12	0	0	3	2	5	0	0	0	0	0	2
	1 19 J PHYS A MATH NUCL G	10	0	0	1	0	0	1	1	0	0	1	6
	07 IEEE T EDUCATION	9	0	1	0	2	1	2	2	1	0	0	0
	09 ARCH HIST EXACT SCI	8	0	1	0	0	1	0	0	1	0	0	5
	1 74 J MOL SPECTROSC	8	0	0	0	1	0	0	0	1	0	0	6
	1 51 USP FIZ NAUK*	8	0	0	0	1	2	1	1	0	0	0	3
	1 39 J PHYS CHEM SOLIDS	7	0	1	0	0	0	0	1	0	1	0	4
	5 41 SCIENCE	7	1	1	2	3	0	0	0	0	0	0	0
	1 94 SOLID STATE COMMUN	7	0	0	0	0	0	2	2	1	0	0	2
	4 06 ASTROPHYS J	6	0	0	0	0	1	2	0	2	0	0	1
	1 02 INT J QUANT CHEM	6	0	0	0	2	3	0	0	0	0	0	1
	2 01 P I ELEC ELEC ENG	6	1	0	2	0	0	2	0	0	0	0	1
	2 21 P ROY SOC LOND A MAT	6	0	0	0	0	0	0	0	0	1	0	5
	1 11 PHYS STATUS SOLIDI B	6	0	1	0	0	0	4	0	0	0	0	1
	ALL OTHER (153)	262	3	21	22	16	22	23	14	20	13	8	100
89	AM J PHYS ANTHROPOL	920*	10	103	106	67	79	57	50	38	32	32	346
	89 AM J PHYS ANTHROPOL	250	2	8	34	23	30	22	16	7	12	2	94
	69 HUM BIOL	61	0	3	11	0	9	6	4	4	2	3	19
	52 J HUM EVOL	57	0	10	12	3	3	6	0	1	4	2	16
	3 13 AM J HUM GENET	26	0	4	5	3	3	0	0	1	0	0	10

Figure 9.8 *Journal Citation Reports (JCR)* Cited Journal Package.

3.23	BRIT J CANCER	14	2	1	1	2	3	1	0	1	2	0	1
60	ENVIRON PHYSIOL BIOC	14	0	0	2	1	0	0	4	0	1	1	5
2.80	J LAB CLIN MED	14	0	1	0	2	2	2	3	1	0	0	3
82	J PHARMACOL-PARIS	14	0	3	4	0	0	1	2	0	1	0	3
6.67	LANCET	14	0	4	2	3	1	0	2	1	0	1	0
22	ACTA PHYSIOL POL	13	0	0	2	0	0	1	2	2	3	0	3
	ALL OTHER (508)	1770	17	155	239	174	155	180	167	96	102	113	372
BIOCHEM PHYSIOL VISU		2*	0	2	0	0	0	0	0	0	0	0	0
2.78	J COMP PHYSIOL	1	0	1	0	0	0	0	0	0	0	0	0
1.00	Z NATURFORSCH C	1	0	1	0	0	0	0	0	0	0	0	0
73 BIOCHEM SOC TRANS		502*	97	398	7	0	0	0	0	0	0	0	0
3.62	BIOCHEM J	73	9	64	0	0	0	0	0	0	0	0	0
73	BIOCHEM SOC TRANS	38	28	10	0	0	0	0	0	0	0	0	0
3.12	BIOCHIM BIOPHYS ACTA	29	4	25	0	0	0	0	0	0	0	0	0
3.04	FEBS LETT	21	5	16	0	0	0	0	0	0	0	0	0
2.91	J ENDOCRINOL	18	0	17	1	0	0	0	0	0	0	0	0
3.87	EUR J BIOCHEM	12	2	10	0	0	0	0	0	0	0	0	0
3.53	J NEUROCHEM	12	6	6	0	0	0	0	0	0	0	0	0
3.63	NATURE	11	5	6	0	0	0	0	0	0	0	0	0
3.74	BIOCHEM BIOPH RES CO	8	1	7	0	0	0	0	0	0	0	0	0
5.84	J BIOL CHEM	8	0	8	0	0	0	0	0	0	0	0	0
7.50	J MOL BIOL	7	3	4	0	0	0	0	0	0	0	0	0
	ORIGINS LIFE	7	0	6	1	0	0	0	0	0	0	0	0
47	GENETIKA*	6	0	6	0	0	0	0	0	0	0	0	0
2.16	J GEN MICROBIOL	6	0	6	0	0	0	0	0	0	0	0	0
6.67	LANCET	6	2	4	0	0	0	0	0	0	0	0	0
1.69	PURE APPL CHEM	6	0	6	0	0	0	0	0	0	0	0	0
	ALL OTHER (131)	234	32	197	5	0	0	0	0	0	0	0	0
BIOCHEM Z		2420*	0	2	1	0	1	4	2	8	199	165	2038
3.12	BIOCHIM BIOPHYS ACTA	131	0	0	0	0	0	0	0	0	15	18	98
5.84	J BIOL CHEM	115	0	0	0	0	0	0	0	0	7	13	95
3.87	EUR J BIOCHEM	100	0	0	0	0	0	0	0	0	8	10	82
3.62	BIOCHEM J	77	0	0	0	0	0	0	0	0	11	5	61
	MOL CELL BIOCHEM	73	0	0	0	0	0	0	0	0	1	0	72
4.71	BIOCHEMISTRY-US	64	0	0	0	0	0	1	0	1	5	1	56
2.29	H-S Z PHYSIOL CHEM	55	0	0	0	0	0	0	0	0	5	5	45
	ARCH BIOCHEM	52	0	0	0	0	0	0	0	0	5	4	43
1.71	J BIOCHEM TOKYO	37	0	0	0	0	0	0	0	0	9	3	25
3.04	FEBS LETT	29	0	0	0	0	0	0	0	0	4	3	22
3.74	BIOCHEM BIOPH RES CO	27	0	0	0	0	0	1	0	0	1	0	25
8.98	P NAT ACAD SCI USA	27	0	0	0	0	0	1	0	1	1	1	23
2.72	J BACTERIOL	26	0	0	0	0	0	0	0	0	5	2	19

Figure 9.8 (continued)

in 1974, 230 citing material published in 1964 or earlier, and the rest being distributed over material published during the years in between.

- It cited itself 243 times and was cited by the *Journal of Chemical Physics* 29 times.
- It has a self-cited rate of 30.4% 243/800).
- Of the citations it received, 28.8% were to material published in 1964 or earlier.
- It was cited as often by *Science* as it was by *Solid State Communications.*

EXPLORATORY STUDIES

Data, of course, is an abstraction. Its utility depends on the types of information that can be derived from it by analysis. A series of studies conducted by ISI demonstrates the most obvious types of information that can be derived from the *JCR* data. Based mostly on a prototype version of the *JCR* that consisted of data from only one quarter of 1969, and that was somewhat less refined (3) than the 1974 data, these studies were not guided by any particular application objective. They were consciously exploratory, with the general purpose of seeing what types of useful information could be uncovered by analyzing citation data on various journals and groups of journals.

There was one exception to this exploratory philosophy. For years, I and a few others had hypothesized that a small fraction of the scientific journals published were responsible for communicating an overwhelming majority of the useful research material reported. The first thing I did with the *JCR* data was to test this

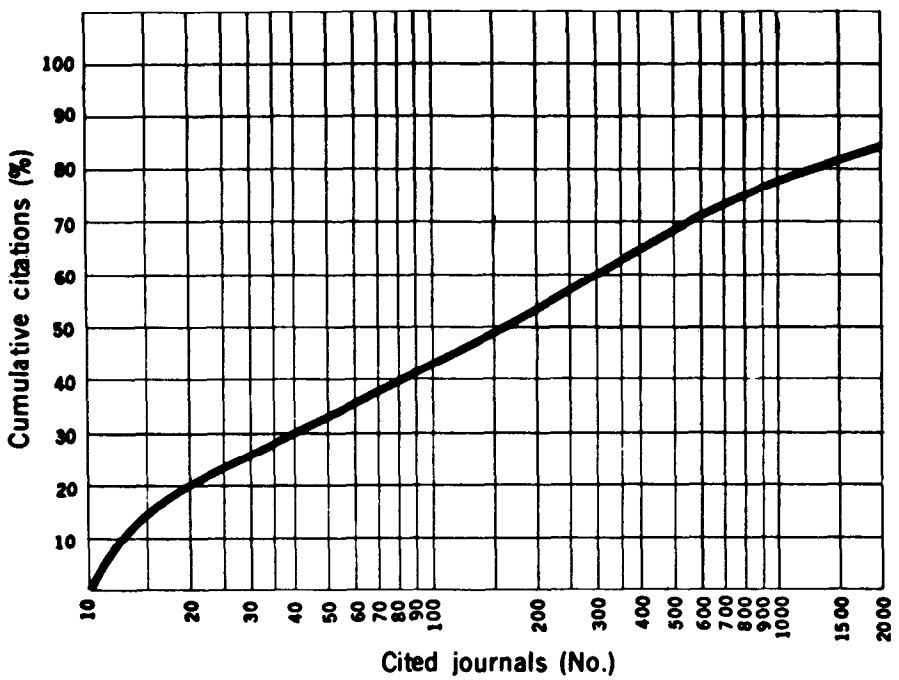

Figure 9.9 Distribution of citations among cited journals.

Item No. (1)	Cited Journal (2)	Times Cited Last Quarter 1969 (3)	1969 Citations to 1967 and 1968 Articles (4)	Articles Published in 1967 and 1968 (5)	Impact Factor (6)
1	J AM CHEM SOC	26323	22156	3946	5.614
2	PHYS REV	20674	20740	5767	3.596
3	J BIOL CHEM	17112	10768	1777	6.059
4	NATURE LONDON	15325	15956	6811	2.342
5	J CHEM SOC	14028	17764	5827	3.048
6	J CHEM PHYS	13690	11696	3738	3.128
7	SCIENCE	9752	11880	3968	2.993
8	BIOCHIM BIOPHYS ACTA	9550	10956	3531	3.102
9	P NAT ACAD SCI USA	8260	11548	1348	8.566
10	BIOCHEM J	7638	6348	2074	3.060
11	LANCET	7617	8164	5496	1.485
12	PHYS REV LETT	6581	11380	2317	4.911
13	CR ACAD SCI	5789	6576	8345	0.788
14	AM J PHYSIOL	5420	3156	1013	3.115
15	J ORG CHEM	5401	5756	2475	2.325
16	J APPL PHYS	5190	5072	2880	1.761
17	P SOC EXP BIOL MED	5079	3468	1920	1.806
18	J MOL BIOL	4982	7340	833	8.811
19	J PHYSIOL LOND	4966	3036	1248	2.432
20	P ROY SOC LOND	4864	1916	621	3.085
21	J CELL BIOL	4813	4596	1357	3.386
22	J CLIN INVEST	4785	3652	1086	3.362
23	J PHYS CHEM	4703	4516	1939	2.329
24	CHEM BER	4541	2128	1037	2.052
25	NEW ENGL J MED	4512	5252	2226	2.359
26	J AM MED ASS	4492	3980	3787	1.050
27	BRIT MED J	4304	4224	6238	0.677
28	SOV PHYS JETP	4295	3400	754	4.509
29	ASTROPHYS J	4271	5440	1167	4.661
30	ANALYT CHEM	4259	2424	1510	1.605
31	J BACTERIOL	4147	4712	1410	3.341
32	BIOCHEMISTRY	4076	6344	1114	5.694
33	NUCL PHYS	4034	6716	2345	2.863
34	PHYS LETT	3943	7160	3034	2.359
35	TETRAHEDRON LETT	3937	8252	2902	2.843
36	J EXP MED	3871	2700	325	8.307
37	ANN NY ACAD SCI	3787	2344	1216	1.927
38	ARCH BIOCHEM BIOPHYS	3689	3776	1169	3.230
39	J GEOPHYS RES	3537	5312	1569	3.385
40	J POLYM SCI	3458	2888	2069	1.395
41	BIOCHEM BIOPHYS RES	3417	5108	1190	4.292
42	FED P	3372	4036	7374	0.547
43	J PHYS	3308	3256	2379	1.368
44	T FARADAY SOC	2922	1808	879	2.056
45	ACTA CRYSTALLOGR	2917	2164	1803	1.200
46	DOKL AKAD NAUK SSSR	2869	2456	5385	0.456
47	J PHARMACOL EXP THER	2781	2020	566	3.568
48	ANGEW CHEM	2728	3660	1251	2.925
49	J IMMUNOL	2627	2992	726	4.121
50	INORG CHEM	2620	3976	1247	3.188
51	SOV PHYS SOLID STATE	2620	2984	1561	1.911
52	CIRCULATION	2601	2624	2160	1.214
53	ENDOCRINOLOGY	2548	2276	783	2.906
54	ACTA CHEM SCAND	2444	1984	943	2.103
55	NUOVO CIMENTO	2431	3436	1938	1.772
56	B SOC CHIM FRANCE	2416	2664	2704	0.985
57	VIROLOGY	2376	2620	584	4.486
58	CANCER RES	2349	2344	814	2.879
59	CAN J CHEM	2280	2392	1182	2.023
60	HELV CHIM ACTA	2249	1524	539	2.827
61	Z NATURFORSCHUNG	2200	2172	1650	1.316
62	AM J MED	2191	1784	395	4.516
63	J LAB CLIN MED	2120	1284	754	1.702
64	TETRAHEDRON	2071	3220	1313	2.452
65	EXP CELL RES	1958	1464	653	2.241
66	LIEBIGS ANN CHEM	1952	768	492	1.560
67	ANN INT MED	1946	1844	1098	1.679
68	PHIL MAG	1943	1180	547	2.157
69	J CLIN ENDOCR METAB	1903	1888	488	3.868
70	J APPL PHYSIOL	1836	1460	643	2.270
71	ACTA PHYSIOL SCAND	1816	1024	413	2.479
72	J PHYS SOC JAP	1786	1768	2074	0.852
73	Z PHYS	1764	1228	844	1.454
74	CIRC RES	1750	1820	432	4.212
75	PHYTOPATHOLOGY	1713	1632	1597	1.021
76	J NAT CANCER I	1668	1672	417	4.009

Figure 9.10 The 152 most frequently cited journals, ranked by frequency of citation in journals covered by *SCI*.

hypothesis. One result of this test is shown in Figure 9.9, a curve of the distribution of citations among cited journals. The curve shows that a core of fewer than 200 journals accounted for the material cited in approximately half the journal references processed for *SCI* in 1969, and that only 2000 or so journals accounted for the material cited in about 84% of them. The data from which the curve was plotted showed that the specific number of journals responsible for the material cited in half the references was 152. It also showed that only 540 journals were cited 1000 or more times that year, and that only 968 journals were cited even 400 times. Another result of this test was a list of the 152 journals that were indentified in 50% of the citations. This list (see Figure 9.10) shows a multidisciplinary mix of journals

Item No. (1)	Cited Journal (2)	Times Cited Last Quarter 1969 (3)	1969 Citations to 1967 and 1968 Articles (4)	Articles Published in 1967 and 1968 (5)	Impact Factor (6)
77	AM J OBSTET GYNECOL	1657	1440	1193	1.207
78	PLANT PHYSIOL	1646	1808	1149	1.573
79	IND ENG CHEM	1644	928	856	1.084
80	ANN SURG	1641	1036	642	1.613
81	B CHEM SOC JAP	1639	2004	1567	1.278
82	EUR J BIOCHEM	1635	1992	501	3.976
83	GENETICS	1618	1340	738	1.815
84	BLOOD	1614	1256	566	2.219
85	P IEEE	1610	1856	756	2.455
86	J OPT SOC AM	1587	1196	1322	0.904
87	ANALYT BIOCHEM	1519	1672	502	3.330
88	J GEN PHYSIOL	1507	1208	407	2.968
89	ARCH INTERN MED	1501	860	486	1.769
90	AM HEART J	1453	1036	539	1.922
91	J EXP PSYCHOL	1449	1152	644	1.788
92	J GEN MICROBIOL	1445	1136	534	2.127
93	J COMP PHYSIOL PSYCH	1444	888	476	1.865
94	J PHYS CHEM SOLIDS	1430	1572	801	1.962
95	CANCER	1416	1224	593	2.064
96	AM J PATHOL	1401	960	529	1.814
97	RUSS J PHYS CHEM	1400	1116	1545	0.722
98	METHODS ENZYMOL	1391	1456	482	3.020
99	J INORG NUCL CHEM	1391	1356	908	1.493
100	PEDIATRICS	1382	1060	709	1.495
101	SURG GYNECOL OBSTET	1374	868	535	1.622
102	ANAT REC	1365	752	1836	0.409
103	REV MOD PHYS	1364	816	189	4.317
104	T MET SOC AIME	1359	1196	901	1.327
105	CAN J PHYS	1352	2156	1019	2.115
106	BRIT J PHARMACOL	1348	1348	507	2.658
107	APPL PHYS LETT	1337	2556	721	3.545
108	PHYS STAT SOLIDI	1329	2192	1485	1.476
109	J ELECTROCHEM SOC	1308	1208	1538	0.785
110	ACTA METALLURG	1304	964	452	2.132
111	PHYS FLUIDS	1304	1548	1050	1.474
112	EXPERIENTIA	1297	1592	1565	1.017
113	GASTROENTEROLOGY	1286	1428	1244	1.147
114	Z ZELLF MIKR ANAT	1286	1800	653	2.756
115	SURGERY	1274	996	790	1.260
116	REV SCI INSTR	1273	968	1148	0.843
117	AM J ROENTGENOL	1272	1044	860	1.213
118	AIAA J	1269	1456	1231	1.182
119	T ASME	1246	800	1332	0.600
120	AM J CARDIOL	1238	1600	737	2.170
121	J HISTOCHEM CYTOCHEM	1229	828	362	2.287
122	J PEDIAT	1229	1076	783	1.374
123	J ACOUST SOC AM	1219	1016	2196	0.462
124	NATURWISSENSCHAFTEN	1218	944	1091	0.865
125	J NUTR	1209	952	489	1.946
126	SPECTROCHIM ACTA	1201	1248	679	1.837
127	Z ANORG ALLG CHEM	1188	580	549	1.056
128	J PERSON SOC PSYCHOL	1186	676	581	1.163
129	RADIOLOGY	1175	1244	835	1.489
130	AM J BOT	1171	644	726	0.887
131	Z PHYS CHEM LEIPZIG	1170	332	252	1.317
132	J CHROMATOGR	1161	1708	1343	1.271
133	HOPPE SEYLERS Z	1145	1412	863	1.636
134	J UROL	1142	656	712	0.921
135	ARCH PATHOL	1138	556	409	1.359
136	ARCH SURG	1134	748	867	0.862
137	AM J DIS CHILD	1127	748	610	1.226
138	ACTA MED SCAND	1112	680	472	1.440
139	ANN PHYSICS	1105	692	224	3.089
140	COLD SPR HARB SYMP	1091	1060	194	5.463
141	J ORGANOMET CHEM	1089	2784	796	3.497
142	PFLUGERS ARCH	1083	896	732	1.224
143	OPT SPECTROSC USSR	1076	1100	814	1.351
144	KLIN WSCHR	1057	800	1198	0.667
145	CHEM IND LOND	1049	648	1703	0.380
146	BER BUNSEN PHYS CHEM	1044	688	771	0.892
147	BIOCHEM PHARMACOL	1030	1292	684	1.888
148	PHYSIOL REV	1022	572	33	17.333
149	J BONE JOINT SURG	1021	500	745	0.671
150	J NEUROPHYSIOL	1015	692	156	4.435
151	CR SOC BIOL	1010	596	1316	0.452
152	REC TRAV CHIM	1010	728	337	2.160

Figure 9.10 (continued)

that makes it obvious that a good, multidisciplinary journal collection need contain no more than a few hundred titles.

These results led to the formulation of the bibliographic law of concentration (4), which goes an important step beyond the Bradford law by stating that the tail of the literature of any one discipline consists, in large part, of the cores of the literature of all other disciplines, and that all the disciplines combined produce a multidisciplinary literature core for all of science that consists of no more than 1000 journals. In fact, this multidisciplinary core might be as small as 500 journals. Though larger collections certainly can be justified in many cases, the single function of providing reasonably cost-effective coverage of the literature most used by research scientists requires no more than 500 to 1,000 journals.

The bibliographic law of concentration has since been validated many times, most notably with an anlysis of 1974 *JCR* data that shows only 206 primary journals and

another 78 review journals have an impact factor of three or higher (5). In addition, the same analysis produced a list of the 206 journals that were cited most frequently in 1974 (Figure 9.11) that was just as multidisciplinary as the one of 152 journals produced from the 1969 data.

The more general types of studies of journal-citation patterns explored the following subjects and produced the following results:

A	B	C		D	E	F
1	1	98995	J. Am. chem. Soc.	4.383	17088	3
2	2	91645	*Physical Rev. (5)	2.670	19174	1
3	3	81353	J. biol. Chem.	5.843	13685	6
4	5	75206	*Nature (5)	4.006	18924	2
5	4	66272	*J. chem. Soc. (9)	1.870	12513	7
6	6	62041	J. chem. Physics	2.918	10462	9
7	8	51491	Biochim. biophys. Acta	3.120	14129	5
8	7	47505	Science	5.412	11781	8
9	9	46917	Proc. natn. Acad. Sci. USA	8.989	15317	4
10	11	37047	Lancet	6.677	10383	10
11	10	31563	Biochem. J.	3.627	4885	23
12	12	29275	Physical Rev. Letters	5.059	10108	11
13	32	27080	Biochemistry	4.711	7325	17
14	25	26726	New Engl. J. Med.	8.364	7385	15
15	22	24768	J. clin. Invest.	6.992	5377	21
16	18	24209	J. molec. Biol.	7.502	6129	18
17	41	23220	Biochem. biophys. Res. Comm.	3.744	8110	12
18	19	22520	J. Physiol. Lond.	4.495	3160	46
19	33	22460	*Nuclear Physics (3)	2.514	7356	16
20	21	22245	*J. Cell Biol. (2)	6.770	3683	38
21	29	22201	Astrophys. J.	4.063	7451	14
22	14	21519	Am. J. Physiol.	2.414	2412	59
23	27	20748	Brit. med. J.	3.556	4829	24
24	56	20699	J. expl Med.	11.874	5557	19
25	15	20539	J. org. Chem.	1.495	3526	40
26	16	19277	J. appl. Physics	1.558	3275	42
27	31	18375	J. Bacteriology	2.727	3809	37
28	30	18190	Analytical Chem.	3.291	4140	32
29	17	18171	Proc. Soc. expl Biol. Med.	1.471	2454	58
30	23	18086	J. phys. Chem.	2.031	2768	54
31	26	17211	J. Am. med. Ass.	3.068	2982	49
32	20	17201	*Proc. R. Soc. (3)	2.350	1114	135
33	13	16782	*C.r. Acad. Sci. (5)	0.529	4247	29
34	35	16509	Tetrahedron Letters	1.777	5004	22
35	38	15970	*Archs Biochem. Biophys. (2)	2.952	3050	48
36	53	15948	Endocrinology	4.337	4098	33
37	49	15826	J. Immunology	5.112	4703	26
38	34	15666	*Physics Letters (2)	2.133	7672	13
39	39	15281	J. geophys. Res.	2.536	3854	36
40	24	14706	*Chem. Ber. (2)	1.506	1353	104
41	37	14668	Ann. N. Y. Acad. Sci.	1.181	1291	113
42	52	14461	Circulation	6.834	4025	34
43	50	14310	Inorg. Chem.	2.457	3589	39
44	45	13911	*Acta crystallographica (3)	1.361	2394	60
45	82	13847	*Eur. J. Biochem. (2)	3.857	4595	27
46	47	13753	J. Pharmacol. expl Ther.	3.576	2026	65
47	42	13072	Fedn Proc.	0.489	4212	30
48	58	12544	Cancer Res.	3.391	3164	45
49	69	11645	*J. clin. Endocr. Metab. (2)	5.170	3443	41
50	43	11459	*J. Physics (7)	1.689	5450	20
51	28	11421	*Zh. eksp. teor. Fiz. (2)	1.565	1607	84
52	57	11371	Virology	3.752	2949	50
53	40	11294	*J. Polym. Sci. (6)	0.964	1565	88
54	65	11127	Exp. Cell Res.	3.014	2788	53
55	48	10756	*Angew. Chem. (2)	4.140	2666	56
56	67	10231	Ann. internal Med.	4.828	2187	63
57	355	10227	Brain Res.	3.104	4522	28

Figure 9.11 Journals most highly cited in 1974. A = rank by 1974 citations. B = rank by 1969 citations. C = total 1974 citations. D = 1974 impact. E = 1974 citations of 1972 and 1973 articles. F = rank by 1974 citations of 1972 and 1973 articles. The citation counts for journal titles marked by an asterisk are aggregates of multiple sections, retitled continuations, translated versions, etc. The number in parentheses after such journals indicates the number of multiple sections, etc., that were included in the aggregate count.

A	B	C		D	E	F
58	87	10206	Analytical Biochem.	2.379	2184	64
59	46	9824	*Dokl. Akad. Nauk SSSR (7)	0.339	1681	81
60	62	9779	Am. J. Med.	4.411	1535	90
61	76	9678	J. natn. Cancer Inst.	3.289	2858	52
62	95	9497	Cancer	2.361	2056	66
63	59	9142	Can. J. Chem.	1.396	1795	73
64	707	9094	FEBS Letters	3.049	4815	25
65	74	9082	Circulation Res.	4.922	1698	79
66	108	9026	*Physica Status Sol. (3)	1.476	3201	44
67	64	8903	Tetrahedron	1.576	1913	69
68	77	8890	Am. J. Obstet. Gynec.	2.100	2236	62
69	78	8835	Plant Physiol.	2.580	1935	68
70	54	8803	*Acta chem. scand. (3)	1.042	1192	124
71	63	8798	J. Lab. clin. Med.	2.802	1132	131
72	113	8693	Gastroenterology	5.394	2260	61
73	107	8625	Appl. Physics Letters	3.220	3246	43
74	70	8619	J. appl. Physiol.	1.780	1184	125
75	481	8478	Applied Physics Letters	2.403	4205	31
76	141	8241	J. organomet. Chem.	2.392	3891	35
77	56	8183	Bull. Soc. chim. France	1.001	1492	96
78	81	7941	Bull. chem. Soc. Japan	0.932	1859	72
79	132	7928	J. Chromatography	2.173	2886	51
80	71	7922	Acta physiol. scand.	2.204	919	170
81	72	7914	J. phys. Soc. Japan	1.132	1500	95
82	61	7860	*Z. Naturforschung (3)	1.070	1503	94
83	192	7794	J. Neurochem.	3.535	2464	57
84	106	7656	*Br. J. Pharmacol.	3.516	1751	77
85	80	7459	Ann. Surgery	2.129	1060	140
86	113	7335	*Cell Tissue Res. (2)	1.961	1761	75
87	122	7183	J. Pediatrics	2.600	1890	70
88	84	7120	Blood	4.319	1529	91
89	60	7117	Helv. chim. Acta	1.649	1034	144
90	68	7063	Philosophical Mag.	1.836	876	178
91	147	7007	Biochem. Pharmacol.	2.023	1689	80
92	100	6951	Pediatrics	2.502	1346	105
93	120	6811	Am. J. Cardiol.	3.704	1889	71
94	276	6788	J. Virology	4.864	3142	47
95	149	6770	*J. Bone Jt Surg. (3)	1.358	729	254
96	73	6662	Z. Physik	1.340	864	182
97	112	6600	Experientia	0.883	1647	83
98	88	6539	J. gen. Physiol.	4.308	741	229
99	51	6362	*Fizika tverd. Tela (2)	0.762	1388	102
100	129	6307	Radiology	1.198	1320	107
101	66	6177	Annln Chemie (J. Liebig)	1.024	432	379
102	89	6066	*Archs internal Med. (2)	2.202	946	163
103	90	5994	Am. Heart J.	1.791	840	188
104	86	5885	J. opt. Soc. Am.	2.016	905	173
105	94	5849	*J. Physics Chem. Solids (2)	1.394	715	239
106	99	5761	J. inorg. nucl. Chem.	0.962	1149	128
107	156	5743	J. Endocrinology	2.919	1757	76
108	217	5683	*J. Pharmaceut. Sci. (3)	1.622	1549	92
109	92	5679	J. gen. Microbiol.	2.160	1136	129
110	115	5675	Surgery	1.559	842	187
111	378	5573	Solid St. Comm.	1.945	2768	55
112	170	5557	Clin. chim. Acta	1.669	1587	86
113	150	5556	J. Neurophysiology	4.537	676	249
114	98	5501	Methods Enzymology	1.765	547	311
115	136	5491	Archs Surgery	1.462	915	171
116	101	5486	Surgery Gynec. Obstet.	1.332	750	226
117	109	5478	J. Electrochem. Soc.	1.053	1098	136
118	55	5474	*Nuovo Cimento (3)	0.994	999	155
119	123	5428	J. acoust. Soc. Am.	1.142	830	195
120	96	5388	Am. J. Pathol.	2.807	856	184
121	91	5388	J. expl Psychol.	1.027	750	226
122	126	5363	*Spectrochim. Acta (3)	1.487	840	188
123	83	5326	Genetics	2.835	995	157
124	158	5197	J. Ultrastruct. Res.	2.709	857	190
125	103	5186	Revs mod. Physics	21.500	731	231
126	121	5167	J. Histochem. Cytochem.	4.005	757	224
127	102	5138	Anat. Rec.	2.884	649	265
128	235	5092	*Zh. obshch. Khim. (2)	0.808	1050	142
129	192	5063	Immunology	2.816	1118	132
130	125	5053	J. Nutrition	1.845	740	230
131	117	5038	Am. J. Roentg. Rad. Ther.	1.008	634	272
132	166	5033	J. Lipid Res.	3.525	719	238
133	134	5031	J. Urology	0.721	776	216
134	194	5000	Life Sciences	2.062	1200	121
135	177	4909	Acta endocrinologica	2.461	1383	103
136	267	4861	J. infect. Dis.	3.040	1669	82
137	75	4847	Phytopathology	1.155	789	210
138	111	4822	Physics Fluids	1.188	972	159
139	116	4801	Rev. scient. Instrum.	1.018	1001	153

Figure 9.11 (continued)

A	B	C		D	E	F
140	160	4767	J. Biochem. Japan	1.715	1079	138
141	184	4707	Nucl. Instrum. Meth.	1.050	1420	100
142	127	4704	Z. anorg. allg. Chem.	1.019	595	286
143	159	4697	J. comp. Neurol.	3.725	771	219
144	105	4656	Can. J. Physics	1.038	774	218
145	168	4655	Lab. Investigation	2.940	932	166
146	133	4604	Hoppe-Seylers Z. physiol.Chem.	2.291	1031	146
147	211	4603	Applied Optics	1.832	1539	89
148	370	4600	Surface Science	3.340	1787	74
149	224	4511	*Comp. Biochem. Physiol. (3)	1.014	1250	116
150	247	4480	Applied Microbiology	1.292	1196	122
151	155	4479	Am. J. clin. Pathol.	1.348	663	255
152	182	4462	Am. J. Surg.	1.183	731	231
153	220	4453	Molecular Physics	2.334	1258	115
154	442	4451	*J. comp. Physiol. (2)	2.782	893	175
155	137	4416	Am. J. Dis. Child.	1.495	809	202
156	162	4393	*Archs Dermatology (3)	1.784	835	192
157	262	4369	Phytochemistry	1.103	1568	87
158	110	4356	Acta Metallurgica	1.705	585	291
159	93	4353	*J. comp. physiol. Psychol. (2)	1.230	663	256
160	140	4348	Cold Spring Harb. Symp.	2.443	623	278
161	139	4347	Ann. Physics	2.128	598	284
162	214	4308	Planta	2.589	1261	114
163	135	4303	Archs Pathology	1.521	508	332
164	85	4277	*Proc. IEEE (2)	2.013	781	215
165	147	4253	Pflugers Arch./Eur. J. Physiol.	1.810	856	184
166	238	4208	*J. Pharmacy Pharmacol. (2)	3.140	1118	132
167	443	4180	*Zh. neorg. Khim (2)	0.523	823	198
168	199	4116	J. Anim. Sci.	1.311	1000	154
169	153	4104	Chem. Revs	11.154	580	293
170	161	4093	J. thorac. cardiovasc. Surg.	1.480	836	191
171	180	4072	*J. cell.Physiol. (2)	3.737	710	240
172	286	4068	J. Reprod. Fert.	2.357	1414	101
173	274	4054	*Transplantation (2)	2.250	1134	130
174	558	4049	Clin. expl Immunol.	4.423	1601	85
175	176	4040	Coll. Czech. chem. Comm.	0.791	831	194
176	169	4031	*Am. Rev. resp. Dis. (3)	1.630	937	165
177	189	4023	Geochim. cosmochim. Acta	4.056	1160	127
178	271	4005	Analytica chim. acta	2.093	1312	110
179	157	4003	*Deut. med. Wschr. (2)	1.022	1025	149
180	148	3996	Physiol. Revs	15.861	499	334
181	138	3993	Acta med. scand.	1.124	508	331
182	195	3952	Diabetes	3.941	863	183
183	97	3932	*Zh. fiz. Khim (2)	0.331	646	266
184	194	3906	Geol. Soc. Am. Bull.	1.674	1026	147
185	364	3899	Astronomy Astrophys.	2.267	2018	67
186	172	3897	J. Dairy Sci.	0.273	569	300
187	218	3892	Neurology	2.181	796	206
188	503	3874	*Int. J. Cancer (2)	4.928	1508	93
189	367	3869	Clinical Chem.	3.195	1460	97
190	171	3864	Am. J. Ophthalmol.	1.389	792	208
190	178	3864	Progr. theor. Physics	1.421	1003	151
192	178	3858	Mon. Not. R. astr. Soc.	2.467	1056	143
193	165	3857	Archs Ophthalmology	1.293	561	302
194	154	3852	J. Fluid Mech.	1.254	617	280
195	146	3827	*Ber. Bunsenges.	1.382	532	319
196	160	3820	J. math. Physics	1.046	632	274
197	339	3777	*J. mednl Chem. (2)	1.444	1196	123
198	369	3726	Gut	3.336	1081	137
199	130	3710	Am. J. Botany	1.378	357	441
200	232	3701	J. Neurosurgery	1.252	636	271
201	204	3699	Scand. J. clin. Lab. Invest.	1.917	644	268
202	249	3673	*Archs Neurol. (2)	2.217	745	228
203	599	3647	*Eur. J. Pharmacol. (2)	2.537	1205	120
204	339	3633	Developmental Biol.	3.584	1242	117
205	196	3561	Arzneimittel-Forschung	0.876	833	193
206	202	3598	*Clin. Sci. mol. Med. (2)	2.474	762	223

Figure 9.11 (continued)

Core Literatures of Chemistry and Biochemistry (6)

Starting with a single leading journal in chemistry and biochemistry, the core literature of each field was defined simply by identifying the journals they cited most frequently. The starting point in chemistry was the *Journal of the American Chemical Society* (*JACS*). The journals it cited most frequently are shown in Figure 9.12. *Biochemistry* was chosen as the starting point for its field, and the journals it cited most frequently are shown in Figure 9.13. In both lists, the journals marked

	Times Cited	Title
1.	14012	*Journal of the American Chemical Society
2.	1920	*Journal of the Chemical Society
3.	1472	*Journal of Organic Chemistry
4.	1376	*Tetrahedron Letters
5.	1036	Chemical Communications
6.	884	*Inorganic Chemistry
7.	820	*Journal of Physical Chemistry
8.	708	*Chemische Berichte
9.	620	*Canadian Journal of Chemistry
10.	568	*Angewandte Chemie
11.	500	*Tetrahedron
12.	400	*Transactions of the Faraday Society
13.	302	*Annalen der Chemie
14.	292	*Journal of Biological Chemistry
15.	252	Bulletin of the Chemical Society of Japan
16.	252	*Helvetica Chimica Acta
17.	240	*Analytical Chemistry
18.	236	*Acta Crystallographica
19.	228	*Accounts of Chemical Research
20.	224	*Chemical Reviews
21.	224	*Journal of Organometallic Chemistry
22.	216	*Acta Chemica Scandinavica
23.	208	Nature
24.	204	*Quarterly Reviews
25.	188	Chemistry and Industry
26.	184	Molecular Physics
27.	180	*Recueil des Travaux Chimiques des Pays-Bas
28.	152	*Biochemistry
29.	144	*Proceedings of the National Academy of Sciences of the United States
30.	140	*Journal of Inorganic and Nuclear Chemistry
31.	120	*Bulletin de la Societe Chimique de France
32.	112	Organic Synthesis
33.	112	Proceedings of the Chemical Society
34.	104	Proceedings of the Royal Society
35.	96	*Biochimica Biophysica Acta
36.	88	*Australian Journal of Chemistry
37.	84	*Biochemical Journal
38.	76	*Advances in Chemistry Series
39.	76	Discussions of the Faraday Society
40.	76	Progress in Physical and Organic Chemistry
41.	76	Gazzetta Chimica Italiana
42.	72	Photochemistry and Photobiology
43.	72	Science
44.	68	Advances in Physical and Organic Chemistry
45.	68	Advances in Organometallic Chemistry
46.	60	*Doklady Akademii Nauk SSSR
47.	60	Physical Review
48.	60	Zhurnal Obshchei Khimii
49.	56	*Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences
50.	56	Pure and Applied Chemistry

Figure 9.12 Journals cited most frequently by *Journal of the American Chemical Society*. Asterisks identify journals that also are major sources of references to *Journal of the American Chemical Society*.

	Times Cited	Title
1.	2836	*Journal of Biological Chemistry
2.	2204	*Biochemistry
3.	1384	*Journal of the American Chemical Society
4.	1260	*Biochimica Biophysica Acta
5.	1044	*Proceedings of the National Academy of Sciences of the United States
6.	724	*Biochemical Journal
7.	632	*Journal of Molecular Biology
8.	612	*Archives of Biochemistry and Biophysics
9.	540	*Biochemical and Biophysical Research Communications
10.	456	*Nature
11.	340	*Federation Proceedings
12.	312	*Science
13.	264	Methods in Enzymology
14.	184	Advances in Protein Chemistry
15.	184	*Analytical Biochemistry
16.	176	Analytical Chemistry
17.	160	*Journal of Chemical Physics
18.	144	*Annals of the New York Academy of Sciences
19.	136	Annual Review of Biochemistry
20.	132	Biochemische Zeitschrift
21.	128	Journal of the Chemical Society
22.	128	*Journal of Physical Chemistry
23.	124	Acta Chemica Scandinavica
24.	112	*Journal of Experimental Medicine
25.	108	Biophysical Journal
26.	104	*Journal of Immunology
27.	96	*Journal of Biochemistry
28.	92	*Hoppe-Seylers Zeitschrift für physiologische Chemie
29.	92	Cold Spring Harbor Symposia on Quantitative Biology
30.	88	*Journal of Bacteriology
31.	88	*Journal of Organic Chemistry
32.	88	Proceedings of the Royal Society
33.	84	*Biopolymers
34.	84	*European Journal of Biochemistry
35.	81	*Journal of Cell Biology
36.	81	*Journal of Clinical Investigation
37.	72	Chemical Communications
38.	68	Journal of General Physiology
39.	64	Advances in Enzymology
40.	64	Tetrahedron Letters
41.	56	Canadian Journal of Chemistry
42.	52	*Immunochemistry
43.	52	Journal of Lipid Research
44.	44	Chemische Berichte
45.	44	*Proceedings of the Society for Experimental Biology and Medicine
46.	40	Brookhaven Symposia in Biology
47.	40	*Endocrinology
48.	40	Helvetica Chimica Acta
49.	40	Journal of Medicinal Chemistry
50.	36	Journal of Neurochemistry

Figure 9.13 Journals cited most frequently by *Biochemistry*. Asterisks identify journals that also are major sources of references to *Biochemistry*.

with an asterisk not only are cited frequently by the subject journals, but also are among the main sources of citations to the subject journals.

An analysis of the two lists shows two distinctly separate core literatures, with very little overlap between them. *JACS* cites very few biochemical journals, whereas *Biochemistry* cites biochemical and biomedical journals heavily. Both draw on each other, of course, but with *Biochemistry* citing *JACS* much more frequently than the other way around.

Rank	Times Cited	Title
1.	14396	*Journal of Chemical Physics
2.	2728	*Physical Review
3.	1284	*Journal of the American Chemical Society
4.	980	*Journal of Physical Chemistry
5.	872	Proceedings of the Royal Society (London)
6.	540	*Transactions of the Faraday Society
7.	508	*Molecular Physics
8.	496	*Physical Review Letters
9.	436	*Journal of the Chemical Society
10.	344	*Acta Crystallographica
11.	316	Physica
12.	312	Zeitschrift für Physik
13.	308	*Journal of Physics
14.	308	*Journal of the Physical Society of Japan
15.	304	*Journal of Molecular Spectroscopy
16.	296	Reviews of Modern Physics
17.	272	*Canadian Journal of Physics
18.	264	Chemical Physics Letters
19.	256	*Spectrochimica Acta
20.	248	Nature
21.	244	*Journal of Applied Physics
22.	240	*Optika i Spektroskopiya
23.	236	*Inorganic Chemistry
24.	232	*Canadian Journal of Chemistry
25.	232	Review of Scientific Instruments
26.	220	Journal of Mathematical Physics
27.	220	*Zeitschrift für Naturforschung
28.	212	Discussions of the Faraday Society
29.	196	Journal of the Optical Society of America
30.	184	*Journal of the Physics and Chemistry of Solids
31.	164	Bulletin of the American Physical Society
32.	156	Zhurnal Eksperimentalnoi i Teoreticheskoi Fiziki
33.	148	*Bulletin of the Chemical Society of Japan
34.	144	Advances in Chemical Physics
35.	144	Proceedings of the National Academy of Sciences USA
36.	140	Rarefied Gas Dynamics. Proc. Internat. Symp.
37.	140	*Journal de Chimie Physique
38.	124	Journal of Research of the National Bureau of Standards
39.	116	*Fizika Tverdogo Tela
40.	112	*Surface Science
41.	104	Advances in Chemistry Series
42.	104	*Chemical Reviews
43.	100	*Physics Letters
44.	100	Science
45.	96	Annual Review of Physical Chemistry
46.	96	*Theoretica Chimica Acta
47.	92	*Comptes Rendus etc. de l'Academie des Sciences (Paris)
48.	92	Solid State Physics
49.	88	*Berichte der Bunsengesellschaft für Physikalische Chemie
50.	88	Annalen der Physik

Figure 9.14 Journals cited most frequently by *Journal of Chemical Physics.* Asterisks identify journals that also are major sources of references to *Journal of Chemical Physics.*

Relationship Between Chemical Physics and Physical Chemistry (7)

Much has been said about the presumed relationship between the physical chemist and the chemical physicist. To test that relationship, a list was compiled of the journals cited most frequently by the *Journal of Chemical Physics* (Figure 9.14), and

then compared to the list previously compiled of the journals most frequently cited by the *Journal of the American Chemical Society* (Figure 9.12). The most striking feature of the *Journal of Chemical Physics* (*JCP*) list is the small number of physical chemistry journals that appear on it, though the *Journal of Physical Chemistry* ranks fourth. The Soviet *Zhurnal Fizicheskoi Khimii* (*ZFK*), for example, is conspicuously absent. Its absence, however, may be due to a bias in the source-journal coverage of *SCI* that is a result of the difficulty and cost of covering journals that do not use Roman alphabets. Some of the Soviet journals not covered may cite *ZFK* frequently enough to improve its rank on this list.

A comparison of the *JCP* and *JACS* lists shows that both journals cite *Nature* and *Science*, and at about the same rate. *Nature* ranks twenty-third on the *JACS* list with a frequency of 208 and twentieth on the *JCP* list with a frequency of 248. *Science* ranks forty-second on the *JACS* list with a frequency of 72 and forty-fourth on the *JCP* list with a frequency of 100. Reflecting their historical orientation toward the life sciences, both of them ranked considerably higher among the journals cited by *Biochemistry* (Figure 9.13).

Journal of Experimental Medicine (8)

The *Journal of Experimental Medicine* (*J. Exp. Med.*) was made the subject of a citation analysis because of its high impact factor. The 1969 data showed its average article was cited 8.3 times, which gave it an impact-factor ranking of thirteenth among the journals covered by *JCR*. Generally, high impact factors indicate basic research, but the title of *J. Exp. Med.* describes it as a medical journal.

Lists of the 40 journals it cited most frequently (Figure 9.15) and the 40 journals that cited it most frequently (Figure 9.16) showed that *J. Exp. Med.* is clearly a journal of immunology. Its references are heavily slanted (in terms of volume) to the biochemical and immunology literature, rather than to the clinical literature. On the other hand, it is heavily cited by clinical journals.

An analysis of the *Journal of Immunology* convincingly confirmed this view of *J. Exp. Med.* as being correct. The top 40 journals it cited most frequently (Figure 9.17) and the 40 that cited it most frequently (Figure 9.18) display an amazing similarity to the lists compiled for *J. Exp. Med.* The most significant difference between the two journals is seen in their citation rates and impact factors. *J. Exp. Med.* ranks higher on both counts: 15,536 versus 10,492 in citation rate and 8.3 versus 4.1 in impact factor.

Though the characterization of *J. Exp. Med.* as an immunology journal—and probably the premier one—may not be news to the people who are familiar with it, there is no doubt that there are many medical librarians who subscribe to it on the grounds that it is a medical journal. Conversely, there probably are many departments of biochemistry and immunology that find those same grounds sufficient reason for not subscribing to it.

The Literature of Rheumatology (9)

Peter Thorpe of Geigy Pharmaceuticals in the U.K. did a citation study of the

Rank	Times Cited	Journal Title Abbreviation
1.	1084	J Exp Med
2.	572	J Immunol
3.	236	Nature
4.	168	Immunology
5.	164	Science
6.	156	Proc Soc Exp Biol Med
7.	128	Internat Arch Allergy Appl Immunol
8.	104	Fed Proc
9.	100	J Biol Chem
10.	92	Biochem J
11.	76	Proc Nat Acad Sci USA
12.	76	Transplantation
13.	72	Ann NY Acad Sci
14.	68	Immunochemistry
15.	64	Cold Spr Harb Symp Quant Biol
16.	60	Biochemistry
17.	56	Biochim Biophys Acta
18.	52	J Clin Invest
19.	44	J Cell Biol
20.	40	Progr Allergy
21.	36	Clin Exp Immunol
22.	32	Adv Immunol
23.	32	Austral J Exp Biol Med
24.	32	J Infect Dis
25.	28	J Allergy
26.	28	Lancet
27.	28	Proc Royal Soc B Biol Sci
28.	24	Am J Pathol
29.	24	Ann Inst Pasteur (Paris)
30.	24	Biochem Biophys Res Comm
31.	24	J Nat Cancer Inst
32.	24	Methods Med Res
33.	20	Am Rev Resp Dis
34.	20	Bacteriol Rev
35.	20	Clin Sci
36.	20	Exp Cell Res
37.	20	J Bacteriol
38.	20	J Biophys Biochem Cytol
39.	20	J Histochem Cytochem
40.	20	J Pathol Bacteriol
	1388	All others (220 other journals)
	5296	TOTAL

Figure 9.15 Journals cited most frequently by *Journal of Experimental Medicine.*

Rank	Times Citing	Journal Title Abbreviation
1.	1408	J Immunol
2.	1084	J Exp Med
3.	512	Proc Soc Exp Biol Med
4.	340	Immunology
5.	288	Transplantation
6.	240	J Bacteriol
7.	236	Klin Wschr
8.	224	Proc Nat Acad Sci USA
9.	220	Thromb Diath Haem
10.	196	Ann NY Acad Sci
11.	196	Science
12.	192	Clin Exp Immunol
13.	188	Fed Proc
14.	184	Ann Rev Microbiol
15.	172	J Infect Dis
16.	172	J Nat Cancer Inst
17.	160	Immunochemistry
18.	152	Experientia
19.	152	J Virology
20.	148	Acta Path Scand
21.	148	Nature
22.	144	Lancet
23.	144	Virology
24.	140	New Engl J Med
25.	128	Am J Med
26.	128	Am J Pathol
27.	124	Am J Vet Res
28.	124	Military Med
29.	116	Am J Cardiol
30.	112	Biochemistry
31.	108	Biochem Biophys Acta
32.	104	Ann Inst Pasteur (Paris)
33.	104	Annu Rev Genetics
34.	104	Cancer Research
35.	104	J Gen Virology
36.	100	Lab Invest
37.	96	J Clin Invest
38.	96	Zbl Bakteriol
39.	92	Brit J Exp Pathol
40.	88	J Med Microbiol
	6768	All others (368 other journals)
	15536	TOTAL

Figure 9.16 Major sources of references to *Journal of Experimental Medicine.*

Rank	Times Cited	Journal Title Abbreviation
1.	2176	J Immunol
2.	1404	J Exp Med
3.	588	Proc Soc Exp Biol Med
4.	576	Nature
5.	412	Science
6.	408	Immunology
7.	244	J Biol Chem
8.	240	Fed Proc
9.	196	J Clin Invest
10.	196	Proc Nat Acad Sci USA
11.	188	Internat Arch Allergy Appl Immunol
12.	184	Immunochemistry
13.	168	Biochem J
14.	156	Biochemistry
15.	144	Lancet
16.	140	Ann NY Acad Sci
17.	140	J Infect Dis
18.	120	Biochim Biophys Acta
19.	108	J Bacteriol
20.	100	Adv Immunol
21.	92	Progr Allergy
22.	88	Cancer Res
23.	84	J Nat Cancer Inst
24.	84	Virology
25.	76	J Allergy
26.	68	Acta Pathol Microbiol Scand
27.	68	New Engl J Med
28.	64	J Molec Biol
29.	64	Transplantation
30.	60	Brit J Exp Pathol
31.	60	Cold Spr Harb Symp Quant Biol
32.	56	Clin Exp Immunol
33.	44	Am J Hyg
34.	40	J Lab Clin Med
35.	40	Austral J Exp Biol Med
36.	40	Bacteriol Rev
37.	40	J Amer Chem Soc
38.	40	Lab Invest
39.	36	Ann Inst Pasteur (Paris)
40.	36	Blood
	3112	All others (392 other journals)
	9068	TOTAL

Figure 9.17 Journals cited most frequently by *Journal of Immunology*.

Rank	Times Citing	Journal Title Abbreviation
1.	2176	J Immunol
2.	572	J Exp Med
3.	396	Proc Soc Exp Biol Med
4.	284	Immunology
5.	204	Transplantation
6.	164	Ann Rev Microbiol
7.	152	Clin Exp Immunol
8.	152	Proc Nat Acad Sci USA
9.	148	J Bacteriol
10.	136	Immunochemistry
11.	132	Nature
12.	132	Science
13.	128	J Pediat
14.	120	Prod Probl Pharmaceut
15.	116	Am J Epidemiol
16.	116	Fed Proc
17.	108	J Nat Cancer Inst
18.	104	Am J Trop Med
19.	104	Biochemistry
20.	104	J Virology
21.	100	Ann NY Acad Sci
22.	100	Fol Biol
23.	96	Am J Cardiol
24.	96	Klin Wschr
25.	92	Appl Microbiol
26.	88	Acta Virol
27.	84	Internat Arch Allergy Appl Immunol
28.	84	J Infect Dis
29.	80	Experientia
30.	80	New Engl J Med
31.	76	Lancet
32.	72	Mycopathol Mycol Appl
33.	68	Biochim Biophys Acta
34.	68	Vox Sanguinis
35.	64	Arch Gen Virol
36.	64	Military Med
37.	60	Acta Microbiol Acad Sci Hung
38.	60	Acta Pathol Scand
39.	56	Ann Intern Med
40.	56	Exp Parasitol
	3400	All others (288 other journals)
	10492	TOTAL

Figure 9.18 Major sources of references to *Journal of Immunology*.

rheumatology literature (10) by identifying the 24 journals most frequently cited by each of the two leading journals in that field. The journals whose citing patterns he analyzed were *Annals of the Rheumatic Diseases* (*Ann. Rheum. Dis.*) and *Arthritis and Rheumatism* (*Arthr. & Rheum.*). His two lists are shown in Figure 9.19. Though he based his study on 1970 citations, his lists agreed with similar ones compiled from the *JCR* data for 1969. To extend his study, ISI went one step further and compiled lists of the most frequent sources of citations to the journals he selected. They are shown in Figure 9.20.

The journals cited by *Ann. Rheum. Dis.* and *Arthr. & Rheum.* (Figure 9.19) are essentially the same: 19 journals are common to both lists. Another point about these two lists is that they demonstrate the bibliographic law of concentration. With only four exceptions, all of the 29 journals that are unique to one or the other of the two lists are among the 450 journals that the multidisciplinary and multispecialty *JCR* shows as being the most frequently cited.

The lists of journals that most frequently cite *Ann. Rheum. Dis.* and *Arthr. & Rheum.* (Figure 9.20) also are remarkably similar. Sixteen journals are common to both of these lists.

However, there are obvious differences between the citing and cited lists. Both *Ann. Rheum. Dis.* and *Arthr. & Rheum.* cite literature more heavily and much more widely than they, in turn, are cited. In the case of *Ann. Rheum. Dis.*, it published 1332 references that cited 305 different journals, whereas it was cited 1252 times by only 71 different journals. Comparable figures for *Arthr. & Rheum.* are 3165 references to 387 journals and 1660 citations from only 103 different journals. As is so often the case, the journal that cites most heavily and widely, *Arthr. & Rheum.* is in turn most heavily and widely cited. Another point of difference between the citing and cited lists is that all the journals cited by *Ann. Rheum. Dis.* and *Arthr. & Rheum.* are published in English, but several journals publishedin French and German appear as major citation sources for them.

Certain journals, namely *Arthr. & Rheum., Ann Rheum. Dis., Acta Med. Scand., Arch. Internal Med., J. Bone Joint Surg.*, and the *Proc. Soc. Exp. Biol. Med.*, appear on all four lists. This strongly suggests, even to someone unfamiliar with the specialty, that these six journals, in addition to the obvious general journals, such as *J. Amer. Med. Assoc., Brit. Med. J., Lancet,* etc., probably are the ones that are the most useful to a rheumatologist.

Relationship Between Pathology and Virology (11)

In an address to a 1971 meeting of the American Phytopathological Association, I used a list of the journals most frequently cited by the journal *Phytopathology* to identify the core literature of the field (Figure 9.21). Everyone in the audience was surprised to find that the second most frequently cited journal, after *Phytopathology* itself, was *Virology*. This unexpected relationship was confirmed by a complementary list of the journals that were the major sources of citations to *Phytopathology* (Figure 9.22). *Virology* ranked a respectable seventh on that list.

	Journals Cited by ANNALS OF RHEUMATIC DISEASES			Journals Cited by ARTHRITIS & RHEUMATISM		
	Title Abbreviation	Times Cited	Cumulated % of Citations	Title Abbreviation	Times Cited	Cumulated % of Citations
*1.	Ann. Rheum. Dis.	211	15.8	*1. Arthr. & Rheum.	291	9.2
*2.	Arthr. & Rheum.	102	23.5	*2. Ann. Rheum. Dis.	188	15.1
*3.	Brit. Med. J.	65	28.3	*3. J. Amer. Med. Assoc.	95	18.1
*4.	Lancet	58	32.7	*4. New Engl. J. Med.	92	20.0
*5.	J. Bone Joint Surg.	55	36.8	*5. Ann. Internal Med.	91	23.9
*6.	J. Clin. Invest.	32	39.2	*6. J. Bone Joint Surg.	90	26.7
*7.	J. Exp. Med.	31	41.3	*7. J. Exp. Med.	81	29.4
*8.	Nature	28	43.7	*8. Lancet	81	32.0
*9.	Acta Rheum. Scand.	27	45.7	*9. Brit. Med. J.	79	34.3
*10.	J. Amer. Med. Assoc.	24	46.6	*10. Amer. J. Med.	78	36.8
*11.	Ann. Internal Med.	23	49.2	*11. J. Clin. Invest.	70	39.0
*12.	Amer. J. Med	22	50.9	*12. Nature	69	41.2
*13.	New Engl. J. Med.	22	52.5	*13. Proc. Soc. Exp. Biol. Med.	67	43.3
*14.	J. Immunology	22	54.2	*14. Acta Rheum. Scand.	62	45.3
15.	Proc. Roy. Soc. Med.	20	56.0	15. Science	56	47.0
*16.	Proc. Soc. Exp. Biol. Med.	18	57.3	*16. J. Lab. Clin. Med.	47	48.5
*17.	Acta Med. Scand.	16	58.5	*17. J. Immunology	44	49.9
*18.	J. Lab. Clin. Med.	16	59.7	*18. Clin. Exp. Immunol.	41	51.2
*19.	Clin. Exp. Immunol.	13	60.4	19. Clin. Orthoped.	40	52.5
*20.	Arch. Internal Med.	12	61.3	*20. Arch. Internal Med.	39	53.7
21.	J. Chronic Dis.	12	62.2	21. Canad. Med. Assoc. J.	27	54.6
22.	Q. J. Med.	12	63.1	22. Fed. Proc.	26	55.4
23.	Immunology	11	64.0	23. Proc. Nat. Acad. Sci. US	26	56.2
24.	J. Path. Bact.	11	64.9	*24. Acta Med. Scand.	25	57.0
	All Other (281)	469	100.0	All Other (363)	1360	100.0
	Total	1332		Total	3165	

Figure 9.19 Journals cited most frequently by *Annals of Rheumatic Disease* and *Arthritis & Rheumatism*. Journals common to both lists are marked by asterisks.

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Journals That Cited ANNALS OF RHEUMATIC DISEASES			Journals That Cited ARTHRITIS & RHEUMATISM		
Title Abbreviation	Times Cited	Cumulated % of Citations	Title Abbreviation	Times Cited	Cumulated % of Citations
*1. Ann. Rheum. Dis.	296	23.6	*1. Arthr. & Rheum.	160	9.6
*2. Arthr. & Rheum.	80	30.0	*2. Mayo Clin. Proc.	136	17.8
*3. Z. Rheumaforsch.	80	36.4	*3. Amer. J. Med.	120	25.1
*4. Acta Med. Scand.	68	41.9	*4. Ann. Rheum. Dis.	76	29.6
*5. Mayo Clin. Proc.	64	47.0	*5. Med. Clin. N. Amer.	60	33.3
*6. Brit. Med. J.	36	49.8	*6. Acta Med. Scand.	56	36.6
*7. Amer. J. Med.	32	52.4	*7. Schweiz. Med. Wschr.	52	39.8
8. Q. J. Med.	32	55.0	*8. Modern Treatment	48	42.7
*9. Schweiz. Med. Wschr.	32	57.5	*9. Deut. Med. Wschr.	44	45.3
*10. Arch. Internal Med.	28	59.7	*10. Arch. Internal Med.	40	47.7
*11. J. Bone Joint Surg.	28	62.0	*11. Brit. Med. J.	40	50.1
*12. Lancet	28	64.2	12. Clin. Exp. Immunol.	40	52.5
13. Amer. J. Epidem.	24	66.1	13. Ann. N. Y. Acad. Sci.	36	54.7
*14. Deut. Med. Wschr.	24	68.1	14. J. Amer. Med. Assoc.	36	56.9
15. Arch. Orthopäd. Unfallchir.	20	69.6	*15. J. Bone Joint Surg.	36	59.0
16. Biochem. Biophys. Acta	20	71.2	16. Rev. Fr. Et. Clin. Biol.	36	61.2
17. Experientia	20	72.8	*17. Amer. J. Path.	32	63.1
18. Clin. Chim. Acta	16	74.1	18. Biochem. J.	32	65.1
*19. Med. Clin. N. Amer.	16	75.4	19. J. Immunol.	28	66.7
*20. Modern Treatment	16	76.7	*20. Proc. Soc. Exp. Biol. Med.	28	68.4
21. Amer. J. Clin. Pathol.	12	77.6	*21. Zschr. Rheumaforsch.	28	70.1
*22. Amer. J. Pathol.	12	78.6	22. Tohoku J. Exp. Med.	24	71.6
23. Biochem. Pharmacol.	12	79.6	23. Amer. J. Clin. Nutr.	16	72.5
*24. Proc. Soc. Exp. Biol. Med	12	80.5	*24. Lancet	16	73.5
All Other (47)	244	100.0	All Other (79)	440	100.0
Total	1252		Total	1660	

Figure 9.20 Major sources of references to *Annals of Rheumatic Diseases* and *Arthritis & Rheumatism*. Journals common to both lists are marked by asterisks.

Rank	No. of citations	Title
1.	3288	Phytopathology (self-citation)
2.	476	Plant Dis. Reporter
3.	320	Virology
4.	240	Canad. J. Bot.
5.	204	Plant Physiol.
6.	188	Amer. J. Bot.
7.	184	Nature
8.	164	Ann. Appl. Biol.
9.	164	Annu. Rev. Phyto-pathol.
10.	148	Phytopathol. Zschr.
11.	144	J. Agric. Res.
12.	120	Science
13.	88	J. Bacteriol.
14.	88	J. Biol. Chem.
15.	80	Mycologia
16.	76	Agronomy J.
17.	76	J. Gen. Microbiol.
18.	72	Trans. Brit. Mycol. Soc.
19.	68	Annu. Rev. Plant Physiol.
20.	60	Austr. J. Biol. Sci.
21.	60	J. Econ. Entomol.
22.	60	Soil Sci.
23.	56	Crop Sci.
24.	56	J. Agric. Food Chem.
25.	52	Ann. Phytopathol. Soc.
	4788	All Other (731 other titles)
	11320	Total

Figure 9.21 Journals cited most frequently by *Phytopathology*.

Rank	No. of citations	Title
1.	3288	Phytopathology (self-citation)
2.	1164	Annu. Rev. Phyto-pathol.
3.	184	Trans. Brit. Mycol. Soc.
4.	168	Canad. J. Bot.
5.	120	Mycologia
6.	112	Mycopathol. Mycol. Appl.
7.	76	Virology
8.	72	Ann. Appl. Biol.
9.	68	Botan. Rev.
10.	60	Canad. J. Microbiol.
11.	56	Canad. J. Plant Sci.
12.	56	Hilgardia
13.	56	Theoret. Appl. Genetics
14.	48	Amer. Potato J.
15.	48	Crop Sci.
16.	48	J. Econ. Entomol.
17.	40	Science
18.	36	J. Bacteriol.
19.	36	J. Gen. Microbiol.
20.	32	J. Stored Prod. Res.
21.	28	C.R. Acad. Sci. D
22.	28	IIRB
23.	28	J. Nematol.
24.	28	Nat. Cancer Inst. Monogr.
25.	28	Radiation Res.
	944	All Other (99 other titles)
	6852	Total

Figure 9.22 Major sources of references to *Phytopathology*.

Later, in an attempt to see whether the relationship between virology and pathology extended to human pathology, I analyzed the citation patterns of *Acta Path. Microb. Scan., Virchows Arch., Pathologie Biologie, J. Pathology,* and *Amer. J. Pathol.* These journals are the top five of the 20 pathology journals covered by *JCR,* when measured by the criteria of the number of references published in 1969. The analysis showed that, with one puzzling exception, they did not cite virology journals at a significant rate. *Virology,* for example, ranked only

Rank	Times Cited	Title
1.	416	Acta path. microb. scand. (self-citation)
2.	240	Nature
3.	148	J. Exp. Med.
4.	116	J. Nat. Cancer Inst.
5.	108	Ann. N.Y. Acad Sci.
6.	104	Arch. Pathol.
7.	104	J. Bacteriol.
8.	96	Amer. J. Pathol.
9.	96	Ann. Human Genetics
10.	96	Proc. Soc. Exp. Biol. Med.
11.	80	Ann. Eugenics
12.	80	J. Histochem. Cytochem.
13.	80	Lancet
14.	76	Biochem. J.
15.	76	J. Biol. Chem.
16.	72	Circulation
17.	72	J. Med. Microbiol.
18.	68	Amer. J. Human Genetics
19.	64	C.R. Acad. Sci.
20.	64	Lab. Invest.
21.	60	Acta genet. med. gemell.
22.	60	J. Immunol.
23.	56.	J. Cell Biol.
24.	52	Virology
25.	48	Cancer Res.
	4408	All Other (601 other titles)
	6940	Total

Figure 9.23 Journals cited most frequently by *Acta Pathologica et Microbiologica Scandinavica.*

Rank	Times Cited	Title
1.	172	Nature
2.	132	J. Bacteriol.
3.	124	Virology
4.	120	J. Gen Microbiol.
5.	116	J. Biol. Chem.
6.	116	J. Molec Biol.
7.	92	Cancer Res.
8.	76	Ann. N.Y. Acad. Sci.
9.	72	Biochem. Biophys. Acta
10.	72	Proc. Soc. Exp. Biol. Med.
11.	64	Biochem. Biophys. Res.
12.	60	Ann. Inst. Pasteur
13.	60	Lancet
14.	60	New Engl. J. Med.
15.	60	Science
16.	56	J. Virology
17.	52	Biochem. J.
18.	52	J. Exp. Med.
19.	52	Presse Med.
20.	44	Arch. Biochem. Biophys.
21.	44	Pathol. Biol.
22.	40	Canad. J. Microbiol.
23.	36	Biokhimiya
24.	36	Endocrinology
25.	36	Proc. Nat. Acad. Sci. US
	2464	All Other (400 other titles)
	4308	Total

Figure 9.24 Journals cited most frequently by *Pathologie Biologie.*

twenty-fourth among the journals cited by *Acta Path. Microb. Scand.* (Figure 9.23).

The exception that was so puzzling was *Pathologie Biologie.* As in the case of *Phytopathology, Virology* ranked third among the journals it cited most frequently (Figure 9.24). What made the finding so puzzling was not only that *Pathologie Biologie* was the only one to show such a strong interest in virology, but that it showed little, if any, interest in plant pathology, which would have explained the relationship with virology.

Interestingly enough, a complementary analysis of the major sources of citations to pathology journals uncovered the same situation, but with a somewhat different set of journals. The five most frequently cited pathology journals in *JCR* are *Amer. J. Pathol., Arch. Pathol., Naunyn-Schmiedebergs Arch. Exp. Pathol. Pharmakol., J. Clin. Pathol.,* and the *Brit. J. Exp. Pathol.* Lists of the major sources of citations to them showed that only one, *Brit. J. Exp. Pathol.,* was cited significantly by virology journals.

This analysis suggested that there may have been a literature gap in the area of applied virology. Certainly the literature on human pathology did not seem to reflect the impact that virology was having on that field, which may be why the report by ter Meulen and Koprowski on the viral factors in multiple sclerosis (12) was published in a general medical journal rather than in one of the specialty virology journals. If there was a literature of applied virology, it probably was scattered throughout the general medical literature. Any publisher looking for a new journal market at that point in time would have been well advised to take a close look at the area of applied virology. This, in fact, happened some time later, when the *Journal of Medical Virology* began publishing.

Journal of Clinical Investigation (13)

Another test of how subtly citation analysis can characterize the editorial orientation of a journal was conducted with the *Journal of Clinical Investigation* (*J. Clin. Invest*). Like the *Journal of Experimental Medicine,* its title suggests that it would be quite useful in a clinical or hospital library as an interface between basic research and clinical practice. The citation analysis showed that, unlike the *Journal of Experimental Medicine,* it did, in fact, cover that area. The journals it cited most frequently (Figure 9.25) showed it had a close relationship to the basic research fronts. Those that cited it most heavily (Figure 9.26) showed that it also had a significant impact on clinical practice. Its utility among clinicians could be seen plainly by defining as clinical any journal whose title contains the words "clinical," "medical," "medicine," or the name of a medical specialty, but that does not contain the words "laboratory," "experimental," or "research." By that criterion, about 30 of the 50 journals that cited *J. Clin. Invest.* most frequently were clinical, whereas only about 12 of the 50 journals it cited most frequently fell into the same category. And in the cases where *J. Clin. Invest.* did cite clinical journals, it usually did so at a rate much lower than the one at which they cited it.

Another facet of the editorial orientation of *J. Clin. Invest.* was shown by the high ranking of the *Journal of Clinical Endocrinology and Metabolism* on both lists. In keeping with this relationship, *Endocrinology* and *Diabetes* also show up as being heavily cited by *J. Clin. Invest.*

A surprising observation is that the *Journal of the American Medical Association* (*JAMA*) does not appear on either list, whereas the *New England Journal of Medicine* ranks high on both of them. A similar situation is found with the *British Medical Journal* and *Lancet. Lancet* ranks high on both lists. The *British Medical Journal,* though it does appear on the list of journals that cited *J. Clin. Invest.*

Rank	Times cited	Journal title abbreviation
*1.	1244	J. Clin. Invest. (1244)
*2.	544	J. Biol. Chem. (168)
*3.	368	Amer. J. Physiology (556)
*4.	260	J. Clin. Endocrinol. Metab. (296)
5.	244	Nature
*6.	204	J. Lab. Clin. Med (188)
7.	196	Science
*8.	172	Biochim. Biophys. Acta (356)
*9.	168	Proc. Soc. Exp. Biol. Med. (360)
*10.	164	Biochem. J. (112)
*11.	160	Lancet (272)
12.	152	Endocrinology
*13.	144	Diabetes (188)
*14.	136	New Engl. J. Med (476)
15.	116	J. Lipid Res.
16.	112	Clin. Res.
*17.	100	Ann. New York Acad Sci. (308)
*18.	100	Blood (96)
19.	96	J. Exp. Med.
*20.	92	J. Appl. Physiology (200)
*21.	84	Am. J. Med. (392)
22.	84	Fed. Proc.
*23.	84	J. Physiology (London) (136)
*24.	80	Circulation Res. (100)
25.	76	Analyt. Biochem.
*26.	76	Circulation (284)
*27.	76	Clin. Science (568)
28.	68	J. Pharmacol. Exp. Ther.
29.	64	Acta Physiol. Scand.
30.	64	Cancer Res.
*31.	60	Ann. Internal Med. (212)
*32.	60	Metabolism (188)
33.	56	Arch. Biochem. Biophys.
34.	56	Biochemistry
*35.	56	Gastroenterology (120)
*36.	56	Thromb. Diath. Haemorrh. (116)
37.	52	Rec. Progr. Hormone Res.
38.	48	J. Amer. Chem. Soc.
*39.	48	Proc. Nat. Acad. Sci. USA (100)
*40.	40	Acta Endocrinologica (132)
*41.	40	Clin. Chim. Acta (140)
*42.	40	Klin. Wschr. (248)
*43.	40	Pflugers Arch. (148)
44.	36	Amer. Heart J.
*45.	36	Amer. J. Obst. Gynecol. (168)
46.	36	Biochem. Pharmacol.
47.	36	Physiol. Rev.
*48.	36	Scand. J. Clin. Lab. Invest. (128)
49.	36	Steroids
50.	32	Atherosclerosis
	6428	Total of first 50
	10336	in 512 other publications
	16764	Total

Figure 9.25 Journals cited most frequently by *Journal of Clinical Investigation (J. Clin. Invest.)* Asterisks indicate journals that also are major sources of references to *J. Clin. Invest.* The numbers in parentheses following these journals show the number of times they cited *J. Clin. Invest.*

Rank	Times cited	Journal title abbreviation
*1.	1244	J. Clin. Invest. (1244)
*2.	568	Clin. Science (76)
*3.	556	Amer. J. Physiol. (368)
*4.	476	New Engl. J. Med. (136)
*5.	392	Amer. J. Med. (84)
*6.	360	Proc. Soc. Exp. Biol. Med. (168)
*7.	356	Biochim. Biophys. Acta (172)
*8.	308	Ann. New York Acad. Sci. (100)
*9.	296	J. Clin. Endocrinol. Metab. (260)
*10.	284	Circulation (76)
*11.	272	Lancet (160)
*12.	248	Klin. Wschr. (40)
13.	232	Acta Med. Scand.
14.	232	Arch. Internal. Med.
*15.	212	Ann. Internal Med. (60)
16.	204	Ital. J. Biochem.
*17.	200	J. Appl. Physiology (92)
18.	196	J. Immunology
*19.	188	Diabetes (144)
*20.	188	J. Lab. Clin. Med. (204)
*21.	188	Metabolism (60)
22.	176	Deut. Med. Wschr.
23.	172	Brit. Med. J.
24.	168	Am. J. Digest. Dis.
*25.	168	Amer. J. Obst. Gynecol. (36)
*26.	168	J. Biol. Chem. (544)
27.	160	Amer. J. Clin. Nutrition
*28.	148	Pflugers Arch. (40)
29.	140	Brit. J. Haematol.
*30.	140	Clin. Chim. Acta (40)
31.	136	Amer. J Med. Sci.
*32.	136	J. Physiology (London) (84)
*33.	132	Acta Endocrinologica (40)
34.	128	Gut
35.	128	Israel J. Med. Sci.
*36.	128	Scand. J. Clin. Lab. Invest. (36)
37.	124	J. Pediatrics
38.	124	Pediatrics
*39.	120	Gastroenterology (56)
40.	116	Amer. Rev. Resp. Dis.
*41.	116	Thromb. Diath. Haemorrh. (56)
42.	112	Ann. Surgery
*43.	112	Biochem. J. (164)
44.	112	Respiration Physiol.
*45.	100	Circulation Res. (80)
46.	100	Danish Med. Bull.
*47.	100	Proc. Nat. Acad. Sci. USA (48)
*48.	96	Blood (100)
49.	96	Med. Clin. North Amer.
50.	92	Beitr. Klin. Tuberk.
	10948	Total of first 50
	8168	in 391 other publications
	19116	Total

Figure 9.26 Major sources of references to *Journal of Clinical Investigation (J. Clin. Invest.)* Asterisks indicate journals that also are frequently cited by *J. Clin. Invest.;* the frequency of citation by *J. Clin. Invest.* is shown by the number in parentheses following the journal name.

(Figure 9.26), ranks much lower than *Lancet* and does not make the list of journals cited by *J. Clin. Invest.* (Figure 9.25) at all.

Journal of the American Medical Association Versus *The New England Journal of Medicine (14)*

The absence of the *Journal of the American Medical Association* (*JAMA*) and the prominence of the *New England Journal of Medicine* (*NEJM*) in the citation study of the *Journal of Clinical Investigation* suggested that the latter was more research oriented than the former. A comparative citation analysis of the two journals was conducted to test that hypothesis. The analysis was based, primarily, on the impact-factor ratings of the journals most frequently cited by *JAMA* and *NEJM,* an approach that was chosen because there is a general correlation between the strength of a journal's impact and the degree of its basic-research orientation.

Lists of the titles of the journals cited most frequently by *JAMA* and *NEJM* showed that there was a considerable difference between the two journals. The average impact factors of the two lists showed the nature of the difference. The top 50 journals cited by JAMA (Figure 9.27) had an average impact of 1.562, whereas the average impact of the top 50 cited by *NEJM* (Figure 9.28) was 2.601. Even when the lists were extended to include the top 100 citation targets, the impact superiority of the *NEJM*-cited journals was maintained: 2.377 versus 2.107. The difference of 0.237 is not as trivial as it might seem. Many journals do not achieve an impact factor as high as 0.237.

This evidence of *NEJM*'s greater research orientation may explain not only its close relationship with the *Journal of Clinical Investigation,* but also its striking superiority to *JAMA* in terms of impact. Although *NEJM* and *JAMA* were cited at approximately the same rate (they ranked twenty-fourth and twenty-sixth, respectively, in terms of total citations in 1969), *NEJM* ranked one hundred-sixtieth in impact, with a rating of 2.45, whereas *JAMA* ranked four hundred seventy-fourth, with a rating of 1.027. In fact, when the letters, editorials, and other nonciteable material that tends to lower the impact factors based on 1969 data were removed, the difference between the two became even more marked.

In less abstract terms, the list of journals most frequently cited by *JAMA* contained all the journals needed to provide reasonably complete coverage of the literature relevant to the interests of a practitioner. The practitioner's university colleague, however, may well prefer to choose his journal collection from the list of journals cited most frequently by *NEJM.*

Pediatrics Literature (15)

A study of the journal literature of pediatrics began with identifying all the pediatrics journals on the list of 1000 journals cited most frequently in 1969. There were 13, and they are shown, in alphabetical order, with their citation rate and impact factor, in Figure 9.29. Initially, the core group of pediatric journals included *Child Development* and *Growth,* but they were subsequently dropped from the study. The reason for dropping them was that the analysis showed their citation

Rank	Times Cited	Cited Journal and Its Impact Factor
1.	1212	J. Amer. Med. Assoc. (1.027)
2.	424	N. Engl. J. Med. (2.453)
3.	200	Ann. Internal Med. (1.640)
4.	200	Lancet (1.509)
5.	148	J. Urology (0.950)
6.	140	Amer. J. Med. (4.694)
7.	140	Arch. Internal Med. (1.610)
8.	128	Brit. Med. J. (0.778)
9.	96	Circulation (1.267)
10.	96	J. Clin. Endocr. Metab. (3.829)
11.	88	Science (2.894)
12.	76	Cancer (2.162)
13.	76	HSMHA Health Rep. (0.451)
14.	72	Arch. Dermatol. (0.567)
15.	68	Amer. J. Med. Sci. (0.582)
16.	68	J. Clin. Invest. (3.461)
17.	60	Nature (2.244)
18.	60	Surgery (1.347)
19.	56	Amer. J. Cardiology (2.240)
20.	56	Amer. J. Dis. Children (1.257)
21.	56	Amer. J. Obst. Gynecol. (1.269)
22.	56	Surg. Gynecol. Obst. (1.578).
23.	52	Ann. Surgery (1.665)
24.	52	Arch. Surgery(0.888)
25.	52	Clin. Res. (0.262)
26.	52	J. Lab. Clin. Med. (1.742)
27.	48	Am. J. Epidemiology (1.846)
28.	48	J. Pediatrics (1.459)
29.	48	Neurology (0.868)
30.	48	Radiology (1.533)
31.	44	Proc. Soc. Exp. Biol. Med. (1.964)
32.	40	Amer. J. Roentgenol. (1.257)
33.	40	Anesthesiology (2.040)
34.	40	Southern Med. J. (0.224)
35.	36	Amer. Heart J. (1.980)
36.	36	Amer. J. Clin. Pathol. (0.625)
37.	36	Amer. J. Physiology (3.379)
38.	36	Amer. J. Psychiatry (0.673)
39.	36	Arch. Gen Psychiatry (1.409)
40.	36	Arthritis Rheumatism (0.672)
41.	36	Canad. Med. Assoc. J. (0.350)
42.	36	J. Med. Education (0.393)
43.	36	Medicine (5.217)
44.	36	Obstetrics & Gynecology (0.816)
45.	36	Pediatrics (1.417)
46.	36	Tr. Amer. Soc. Art. Int. Org. (1.367)
47.	32	Arch. Environmental Health (0.632)
48.	32	Arch. Neurol. (1.449)
49.	28	Amer. J. Surgery (0.992)
50.	28	Gastroenterology (1.189)
	4692	Total of first 50
	9360	in 788 others
	14052	Grand Total

Figure 9.27 Journals cited most frequently by *Journal of the American Medical Association.*

Rank	Times Cited	Cited Journal and Its Impact Factor
1.	1172	New Engl. J. Med (2.453)
2.	476	J. Clin. Invest. (3.461)
3.	356	Lancet (1.509)
4.	352	J. Biol. Chem. (6.371)
5.	348	Amer. J. Med (4.694)
6.	308	Ann. Internal Med. (1.640)
7.	300	Circulation (1.267)
8.	288	J. Amer. Med. Assoc. (1.027)
9.	216	Amer. J. Cardiology (2.240)
10.	208	Science (2.894)
11.	196	Brit. Med. J. (0.778)
12.	180	Nature (2.244)
13.	176	J. Clin. Endocrinol. Metab. (3.829)
14.	172	Blood (2.867)
15.	140	Amer. Heart J. (1.980)
16.	140	Arch. Internal Med. (1.610)
17.	140	J. Exp. Med. (9.030)
18.	136	Gastroenterology (1.189)
19.	120	Amer. J. Physiology (3.379)
20.	116	Pediatrics (1.417)
21.	112	Biochem. Biophys. Res. Comm. (4.468)
22.	112	J. Am. Vet. Med. Assoc. (0.448)
23.	112	J. Bacteriol. (3.594)
24.	112	Proc. Nat. Acad. Sci. USA (8.828)
25.	108	Biochim. Biophys. Acta (3.287)
26.	108	Proc. Soc. Exp. Biol. Med. (1.964)
27.	104	Brit. J. Haematol. (2.179)
28.	100	J. Lab. Clin. Med. (1.742)
29.	100	J. Pediatrics (1.459)
30.	88	Ann. New York Acad. Sci. (1.815)
31.	88	Medicine (5.217)
32.	84	J. Heredity (0.600)
33.	80	Clin. Res. (0.262)
34.	80	J. Immunology (4.305)
35.	76	Brit. Heart J. (1.697)
36.	76	Fed. Proc. (0.568)
37.	76	Radiology (1.533)
38.	72	Am. J. Vet. Res. (0.831)
39.	72	Biochem. J. (3.193)
40.	72	Cancer Res. (3.084)
41.	68	Arch. Biochem. Biophys. (3.519)
42.	68	Arch. Pathology (1.509)
43.	68	Biochemistry (5.906)
44.	68	Diabetes (2.039)
45.	60	Amer. J. Dis. Children (1.257)
46.	60	Amer. J. Med. Sci. (0.582)
47.	56	Amer. J. Clin. Pathol. (0.623)
48.	56	Q.J. Med. (4.238)
49.	52	Acta Med. Scand. (1.534)
50.	52	Amer. J. Pathology (1.916)
	7980	in first 50
	17248	in 1019 other publications
	25228	Grand Total

Figure 9.28 Journals cited most frequently by *New England Journal of Medicine.*

links to the other 13, as either the object or source of citations, to be very weak. An examination of the two journals showed that *Child Development* dealt with psychology and education and *Growth* was concerned mainly with biochemistry and physiology.

The next step was a compilation of the 100 journals most frequently cited by the 13 core journals (Figure 9.30). While one would expect that all 13 of the original journals would rank high on such a list (on the strength of self- citation if nothing else), only seven of them appeared among the top 25. When self- citations were excluded from the counts, only nine of the original 13 remained among the top 100 journals they had cited. Of the four that dropped off the list, one was French, one was German, and two dealt with the subspecialty areas of pediatric surgery and neonatal physiology. When all 13 of the original core journals were excluded from the list to examine the tail of the pediatrics literature, it was found that the journals remaining were the same ones that were cited most frequently by the *Journal of the American Medical Association,* the *New England Journal of Medicine,* and the *Journal of Clinical Investigation*—another demonstration of the law of bibliographic concentration.

On the other hand, the list of journals most cited by the 13 included three journals that were not among the 1000 most cited journals of science but, nevertheless, seemed to play an important role in pediatrics: *Clinical Pediatrics, Pediatrie,* and

	Times Cited 1969	Impact Factor	Journal Title
1.	1256	0.678	Acta Paediat. Scand.
2.	4508	1.257	Amer. J. Dis. Children
3.	2376	1.383	Arch. Dis. Childhood
4.	452	0.162	Arch. Franc. Pediat.
5.	372	0.884	Biol. Neonat.
6.	372	0.236	Dev. Med. & Child Neur.
7.	556	1.128	Helv. Paediat. Acta
8.	392	0.539	J. Pediat. Surg.
9.	4916	1.459	J. Pediatrics
10.	524	0.548	Pediat. Clin. N. Amer.
11.	808	0.680	Pediatric Res.
12.	5528	1.417	Pediatrics
13.	492	0.480	Zschr. Kinderheilk

Figure 9.29 Pedatric journals among the 1000 most highly cited journals.

Rank	Times Cited 1969	Journal Title
1.	2088	**Pediatrics**
2.	1768	**J. Pediatrics**
–	1616	*Pediatrics*
3.	1412	**Amer. J. Dis. Children**
4.	1412	Lancet
–	1172	*Amer. J. Dis. Children*
5.	1164	New Engl. J. Med.
–	1080	*J. Pediatrics*
6.	872	**Arch. Dis. Childhood**
7.	776	J. Amer. Med. Assoc.
–	716	*Arch. Dis. Childhood*
8.	604	Brit. Med. J.
9.	428	J. Clin. Invest.
10.	412	J. Biol. Chem.
11.	396	J. Clin. Endocrin. & Metab.
12.	380	**Acta Paediat. Scand.**
13.	364	J. Urology
14.	324	Science
15.	304	Surgery
16.	300	Nature
–	272	*Acta Paediat. Scand.*
17.	260	Amer. J. Med.
18.	256	Ann. Surgery
19.	244	Amer. J. Obst. Gyn.
20.	224	**Pediatric Res.**
21.	204	J. Lab. Clin. Med.
22.	200	Proc. Soc. Exp. Biol. Med.
23.	192	Ann. Internal Med.
24.	180	Circulation
25.	180	**J. Pediat. Surg.**
26.	176	Arch. Surgery
27.	172	J. Immunology
28.	172	Radiology
29.	172	Amer. J. Roentgenol.
30.	168	J. Thor. Cardiovasc. Surg.
31.	164	Surg. Gynecol. Obst.
32.	164	Biochem. J.
33.	156	**Pediat. Clin. N. Amer.**
	156	*Pediat. Clin. N. Amer.*
34.	152	Arch. Pathology
35.	148	Amer. J. Pathology
36.	144	J. Cell Biol.
37.	132	**Biol. Neonat.**
38.	132	J. Exp. Med.
39.	124	Amer. J. Surgery
40.	120	Proc. Nat. Acad. Sci. US
41.	120	Arch. Internal Med.
42.	112	Amer. J. Med. Sci.
43.	112	Amer. Rev. Resp. Dis.
44.	112	**Amer. J. Cardiology**
45.	112	**Arch. Franc. Pediat.**
46.	112	Canad. Med. Assoc. J.
47.	108	Ann. New York Acad. Sci.
48.	108	Deut. Med. Wschr.
49.	108	**Dev. Med. Child Neurol.**
50.	108	J. Physiol. (London)
51.	104	Develop. Biology
52.	100	Amer. Heart J.
53.	100	J. Appl. Physiol.
54.	100	Med. J. Australia
55.	100	Neurology
56.	92	Acta Endocrin.
57.	92	Amer. J. Physiol.
58.	92	Blood
59.	92	**Helv. Pediat. Acta**
60.	88	**Zschr. Kinderheilk.**
61.	84	Arch. Neurology
62.	84	Clin. Pediat.
63.	84	J. Exp. Zoology
64.	80	Brit. J. Surgery
65.	80	J. Med. Microbiol.
66.	76	Amer. J. Clin. Pathol.
67.	76	Cancer
68.	76	J. Neuropath. Exp. Neur.
–	76	*Pediatic Res.*
69.	72	Brit. Heart J.
–	72	*Dev. Med. Child Neurol.*
70.	72	Federation Proc.
71.	72	J. Endocrinology
72.	64	Amer. J. Human Genet.
73.	64	Brain
74.	64	Brit. J. Urology
75.	64	Pediatrie
76.	60	Biochim. Biophys. Acta
–	60	*Helv. Paediat. Acta*
77.	56	Chest
78.	56	Lab. Invest.
79.	56	Medicine
80.	56	Monatschr. Kinderheilk.
81.	56	Proc. Roy. Soc. Med.
82.	52	Amer. J. Mental Defic.
83.	52	Clin. Sci.
84.	52	Exp. Cell Res.
85.	52	Gastroenterology
86.	52	J. Clin. Pathology
87.	52	J. Neurosurg.
88.	52	Presse Med.
89.	48	Amer. J. Pub. Health
90.	48	Anat. Record
91.	48	Brit. J. Prev. Soc. Med.
92.	48	Electroencephal. Clin. Neurophys.
93.	48	Endocrinology
94.	48	Klin. Wschr.
95.	48	Metabolism
96.	48	Surg. Clin. N. Amer.
97.	44	Arch. Gen. Psychiat.
98.	44	Biochemistry
99.	44	Birth Defects Origin
100.	44	South. Med. J.
–	40	*Arch. Franc. Pediat.*
–	36	*Biol. Neonat.*
–	32	*J. Pediat. Surg.*
–	12	*Zschr. Kinderheilk.*

Figure 9.30 Journals cited most frequently by the highly cited pediatric journals. The journals from which the study data base was compiled appear twice: once in bold type and once in italic. The bold-type entry shows the total citation count. The italic entry shows the total citation count minus self-citations; its position on the list indicates its ranking by this measure.

Monatschrift fur Kinderheilkunde. One-third to half of all the citations received by these three came from four of the core group of pediatric journals.

The high ranking of *Lancet* among the top 100 pediatric journals (Figure 9.30) probably can be attributed, in part, to its heavy interest in human genetics. If that is true, however, it is surprising that the *Amer. J. Human Genet.* ranked only seventy-second on the list, and that the purely genetics journals were completely absent.

Geology and Geophysics (16)

Another way of using *JCR* to define the literature of a particular field was tested with the subject of geology and geophysics. The choice of field was a response to a letter to the editor of *Science,* where the development of *JCR* was first reported, by N. C. Janke of the Department of Geology of the California State University of Sacramento (17). He warned against the use of citation data in journal evaluations and implied that citation data understated the importance of journals in small fields, among which he included his own.

The study began with the assumption that the person doing the analysis would be aware of the existence of the *Journal of Geology.* If so, *JCR* showed that it cited the following journals most frequently:

- *J. Geology* (self-citations).
- *B. Geol. Soc. Amer.*
- *Science*
- *Amer. J. Science*
- *J. Sediment. Petrol.*
- *B. Amer. Assoc. Petrol. Geol.*
- *Nature*
- *J. Geophys. Res.*
- *Geol. Soc. London Quart.*
- *Amer. Mineralogist*

The next stop was to develop a list of the journals most frequently cited by those 10. The result was the list of 132 journals shown in Figure 9.31, where they are ranked by the number of times they were cited by the core group of 10 geology journals.

A separate analysis of the *Amer. J. Science* was conducted to determine whether it was a general-science journal that is important to the field or a hard-core specialty journal of the field. Its title, of course, implies that it is a general-science journal. The title, however, turned out to be deceptive. When the number of times the *Amer. J. Science* was cited by the core group of geology journals was calculated as a percentage of the total number of times it was cited by all journals (936/1940), 48% of its citations were found to come from the former. In contrast, only 4% of the citations to *Science* (1616/39,000) came from the geology journals.

An interesting finding in the list of 132 journals most frequently cited by the core group of geology journals (Figure 9.31) is that the twentieth position is held by "Theses," which are a form of scientific literature that seldom plays a very prominent role in the communications of a field. Sixty-eight of the references to these theses cited ones written at Oregon State University.

Rank	Times Cited 1961-1972	Journal Title
1.	8032	J. Geophys. Res.
2.	1704	Geochim. Cosmochim. Acta
3.	1616	Science
4.	1608	Astrophysical J.
5.	1452	Nature
6.	1292	B. Geol. Soc. Amer.
7.	1184	Economic Geology
8.	1164	B. Seismol. Soc. Amer.
9.	1164	Planet. Space Sci.
10.	1120	J. Atmos. Sci.
11.	1040	J. Sediment. Petrol.
12.	1004	J. Geology
13.	936	Amer. J. Science
14.	908	Amer. Mineralogist
15.	772	J. Atmos. Terr. Phys.
16.	748	Trans. Amer. Geophys. Union
17.	584	Soil Sci. Soc. Amer. Proc.
18.	580	Deep-Sea Res.
19.	580	Earth Planet. Sci. Lett.
20.	552	Theses
21.	528	B. Amer. Assoc. Petrol. Geol.
22.	524	Geophys. J. Roy. Astr. Soc.
23.	508	Izv. Akad. Nauk SSSR FAO
24.	460	Canad. J. Phys.
25.	432	J. Chem. Phys.
26.	428	Proc. Roy. Soc. Lond.
27.	420	Phys. Rev.
28.	416	Ann. Geophysique
29.	416	Icarus
30.	396	J. Petrology
31.	368	Soil Sci.
32.	360	Tellus
33.	336	Space Res.
34.	328	Geophysics
35.	324	Quart. J. Roy. Meteorol. Soc.
36.	320	Astron. Zh.
37.	308	J. Fluid Mech.
38.	288	New Zealand J. Geol. Geophys.
39.	280	Canad. J. Earth Sci.
40.	272	J. Marine Res.
41.	268	Mineralogical Mag.
42.	268	Rev. Geophys. Space Phys.
43.	244	Hydrocarbon Processing
44.	236	Doklady Akad. Nauk SSSR
45.	236	Geomagnetizm Aeronomiya
46.	220	Astronomical J.
47.	208	Contr. Miner. Petrol.
48.	208	Space Sci. Rev.
49.	192	Quart. J. Geol. Soc. London
50.	188	Appl. Optics
51.	184	Mon. Not. Roy. Astr. Soc.
52.	184	Radioscience
53.	180	J. Appl. Phys.
54.	180	J. Opt. Soc. Amer.
55.	176	Marine Geology
56.	176	Phil. Trans. Roy. Soc. Lond.
57.	176	Phys. Fluids
58.	172	Sov. Soil Sci.
59.	172	J. Soil Sci.
60.	168	Izv. Akad. Nauk. SSSR
61.	164	Mon. Weather Rev.
62.	164	Phys. Rev. Lett.
63.	160	J. Phys. Chem.
64.	148	Carnegie Inst. Yb.
65.	144	Geol. Mag.
66.	140	B. Earthquake Res. I.T.
67.	132	J. Appl. Meteorol.
68.	120	Acta Crystallogr.
69.	116	J. Amer. Chem. Soc.
70.	112	Philosophical Mag.
71.	112	Zschr. Kristallogr.
72.	100	Geokhimiya
73.	100	US Geol. Surv.
74.	96	J. Palaeontology
75.	96	Metallurg. J.
76.	92	J. Amer. Ceramic Soc.
77.	92	Smithsonian Contr. Astrophys.
78.	84	J. Meteor. Soc. Japan
79.	80	Comptes Rendus etc.
80.	76	Agronomy J.
81.	76	Ind. Eng. Chem.
82.	76	J. Physics
83.	76	Sedimentology
84.	76	Trans. Roy. Soc. New Zealand
85.	72	J. Geomagn. Geoelect.
86.	72	Meteorologiya Gidrologiya
87.	72	New Zealand J. Sci. Techn.
88.	68	Radiocarbon
89.	68	Rev. Mod. Phys.
90.	64	B. Amer. Meteorol. Soc.
91.	64	Geochem. Int.
92.	64	J. Geol. Soc. Australia
93.	60	Astronomy & Astrophysics
94.	60	Proc. IEEE
95.	60	Tectonophysics
96.	60	Zschr. Naturforsch.
97.	56	Agrokhimiya
98.	56	B. New Zealand Geol. Surv.
99.	56	Dev. Sediment. Petrol.
100.	56	Limnol. Oceanogr.
101.	56	Norsk Geol. Tskr.
102.	56	Opt. Spectrosc. USSR
103.	56	Rep. Ionosph. Space Res.
104.	56	Soc. Petrol. Eng. J.
105.	52	Clays Clay Minerals
106.	52	Mining Mag.
107.	48	Z. Petrol. Technol.
108.	48	Trans. Faraday Soc.
109.	44	J. Acoust. Soc. Amer.
110.	44	Philippine Geologist
111.	44	Publ. Astron. Soc. Pacific
112.	44	Rev. Mod. Phys.
113.	40	Australian J. Physics
114.	40	B. Marine Sci.
115.	40	Fuel
116.	40	Geol. Assoc. Proc.
117.	40	Mineralium Deposita
118.	36	B. Volcanol.
119.	36	Comm. Lunar Planet.
120.	36	Res. Geochem.
121.	32	Chem. Geol.
122.	32	J. Quant. Spectrosc.
123.	32	Meteor. Z.
124.	32	Plant & Soil
125.	28	Australian J. Soil Res.
126.	28	B. Can. Petrol. Geol.
127.	28	Geol. J.
128.	28	Int. Geol. Rev.
129.	28	J. Mol. Spectroscopy
130.	28	Meteor. Monogr.
131.	24	Proc. Nat. Acad. Sci. USA
132.	24	Publ. Astron. Soc. Japan

Figure 9.31 Highly cited journals in geology and geophysics.

references to other publications. In all, it cited 323 other publications, though some of them were books, reports, theses, and other nonjournal material. Interestingly enough, the number of references that cited its own material amounted to only 14% of the number it published; so its self-citing rate was considerably lower than its self-cited rate.

The importance of *Science* and *Nature* in the research continuum that stretches from geology to astrogeophysics was demonstrated by the fact that both of them ranked among the top five journals cited by *JGR* and among the top seven sources of citations to *JGR*. The latter point shows the strong geophysical orientation of the two multidisciplinary journals. Undoubtedly, the review quality of many of the articles published in *Science* and *Nature* account, to a significant extent, for the frequency with which *JGR* cited them.

	Times Cited	Journal Title
1.	3636	J. Geophys. Res
2.	380	Science
3.	356	Planet. Space Sci.
4.	284	Trans. Amer. Geophys. Union
5.	276	Nature
6.	268	Bull. Seismol. Soc. Amer.
7.	232	Geochim. Cosmochim. Acta
8.	212	Canad. J. Physics
9.	184	Astrophys. J.
10.	172	Phys. Rev.
11.	168	J. Atmosph. Terr. Phys.
12.	140	Proc. Roy. Soc. London
13.	128	Geol. Soc. Amer. Bull.
14.	124	Phys. Fluids
15.	116	J. Atmosph. Sci.
16.	112	Rev. Geophys. Space Phys.
17.	104	Geophys. J. Roy. Astr. Soc.
18.	104	Tellus
19.	100	J. Chem. Phys.
20.	96	J. Appl. Phys.
21.	92	Ann. Geophysique
22.	76	Quart. J. Roy. Meteorol. Soc.
23.	72	Bull. Earthquake Res. I. T.
24.	72	Deep-Sea Res.
25.	72	Phys. Rev. Lett.
	17468	All Other (298 Journals)
	25044	Total

(continued)

Figure 9.33 Journals cited most frequently by *Journal of Geophysical Research*.

Acta Crystallographica (19)

A letter from Professor Werner Baur, of the University of Illinois at Chicago, led to a study of *Acta Crystallographica* (*Acta Crystallogr.*). The letter pointed out that a

1972 list published by ISI of the 100 most cited chemical papers included 19 on the subject of crystallography, and that 15 of the 19 had been published in (*Acta Crystallogr.*), led to a study of that journal.

The 25 journals most often cited by *Acta Crystallogr.* are shown in Figure 9.34, while the 25 that cited *Acta Crystallogr.* most often are shown in Figure 9.35.

The top 25 journals cited by *Acta Crystallogr.* accounted for about 64% of its references. Significantly, the top six journals, by themselves, accounted for 50% of its references. This narrow citing pattern is dominated by a high degree of self-citation, with *Acta Crystallogr.* showing a self-citing rate of 36%. Overall, *Acta Crystallogr.*'s 7752 references in 1969 cited 440 different publications, mainly journals, but also books, theses, reports, and other nonjournal material.

The list of the 25 journals that cited *Acta Crystallogr.* most often showed that it was cited half again as often as it cited other publications: 11,588 versus 7751. The 11,588 citations came from approximately 280 journals, with the top seven journals accounting for half the total. *Nature* ranks only twenty-second as a source of citations, just below *Sov. Phys. Crystallogr. USSR. Science,* which ranked fourteenth

RANK	Times Cited 1969**	Cumulative Percent of Citations ↓	Journal
1.	2788	36.0	*Acta Crystallogr.
2.	320	40.1	*J. Chem. Soc.
3.	316	44.2	*J. Amer. Chem. Soc.
4.	236	47.2	*J. Chem. Phys.
5.	140	49.0	*Nature
6.	112	50.5	*Z. Kristallogr.
7.	108	51.9	Proc. Roy. Soc. London
8.	96	53.1	*Acta Chem. Scand.
9.	96	54.3	*Inorg. Chem.
10.	96	55.6	Ricerca Scientifica
11.	92	56.8	*J. Molec. Biol.
12.	56	57.5	*Phys. Rev.
13.	56	58.2	Comp. Meth. Phys.
14.	52	58.9	Science
15.	44	59.4	*B. Chem. Soc. Japan
16.	40	60.0	Ark. Kemi
17.	36	60.4	J. Phys. Chem. Solids
18.	36	60.9	J. Phys. Chem.
19.	32	61.3	J. Inorg. Nucl. Chem.
20.	32	61.7	*Phys. Stat. Solidi
21.	32	62.1	*J. Phys. Soc. Japan
22.	32	62.5	Tetrahedron
23.	28	62.9	*J. Appl. Phys.
24.	28	63.3	Angew. Chem.
25.	28	63.5	Physica
	4932	63.6	Total of above 25 journals
	2820	36.4	Citations to 416 other items
	7752	100.0	Total citations

**Figures are an annual extrapolation from a quarterly sample.

Figure 9.34 Journals cited most frequently by *Acta Crystallographica.* Those marked with an asterisk also are major sources of references to *Acta Crystallographica.*

among the journals cited by *Acta Crystallogr.*, did not rank at all among the top 25 sources of citations to *Acta Crystallogr.*, which indicates that its role in the literature of crystallography is minimal.

Fourteen journals are common to the two lists, with the *J. Chem. Soc., Inorg. Chem., Acta Chem. Scand., J. Amer. Chem. Soc., J. Chem. Phys., Z. Kristallogr.,* and *J. Molec. Biol.* being especially noteworthy because of their high rankings on both lists. To anyone unfamiliar with molecular biology, the prominence of *J. Molec. Biol.* in the literature of crystallography would be totally unexpected.

RANK	Times Citing 1969**	Cumulative Percent of Citations ↓	Journal
1.	2788	24.1	*Acta Crystallogr.
2.	756	30.6	*J. Chem. Soc.
3.	596	35.7	*Inorg. Chem.
4.	532	40.3	*Acta Chem. Scand.
5.	388	43.7	*J. Amer. Chem. Soc.
6.	372	46.9	Annu. Rep. Progr. Chem. B
7.	364	50.0	*J. Chem. Phys.
8.	260	52.3	*Z. Kristallogr.
9.	192	53.9	Z. Naturforsch. B.
10.	180	55.5	*J. Molec. Biol.
11.	172	57.0	*J. Appl. Phys.
12.	164	58.4	*Phys. Stat. Solidi
13.	144	59.6	B. Soc. Chim. France
14.	140	60.8	Z. Anorg. Allg. Chem.
15.	120	61.9	Helv. Chim. Acta
16.	120	62.9	*Phys. Rev.
17.	116	63.9	Canad. J. Chem.
18.	112	64.9	J. Less-Common Met.
19.	96	65.7	*J. Phys. Soc. Japan
20.	96	66.5	Proc. Nat. Acad. Sci. USA
21.	96	67.3	Sov. Phys. Crystallogr. USSR
22.	92	68.1	*Nature
23.	84	68.9	*B. Chem. Soc. Japan
24.	76	69.5	J. Appl. Crystallogr.
25.	76	70.2	Rec. Trav. Chim.
	8132	70.2	Total of above 25 journals
	3456	29.8	Citations from 264 other items
	11588	100.0	Total citations

**Figures are an annual extrapolation from a quarterly sample.

Figure 9.35 Major sources of references to *Acta Crystallographica.* Those marked with an asterisk also are among those cited most frequently by *Acta Crystallographica.*

Physics (20)

A study of the physics literature, inspired by Inhaber's ranking of the 24 top physics journals by citation rate, impact factor, and immediacy index (21), showed that the physics journals that are most frequently cited by physicists are considerably different from those most frequently cited by the scientific community at large.

Two types of analysis were used in the study. The first consisted of compiling the

	Journal	'Physical' Citations A	Self-Citations B	Self-Citation Rate (B/A)	Total Citations D	'Physical' Citation Rate (A/D)	Number of Physics Journals Citing	Impact Factor
1.	Phys. Rev.	74224	17808	24.0	82664	89.8	113	3.679
2.	J. Chem. Phys.	27256	14396	52.8	54748	49.8	87	3.180
3.	Phys. Rev. Lett.	23792	2432	10.2	26176	90.9	77	5.114
4.	Nucl. Phys.	15544	6012	38.7	16044	96.8	46	0.858
5.	Sov. Phys. JETP	15196	4564	30.0	16852	90.2	63	3.944
6.	Phys. Lett.	14320	1568	10.9	15740	91.0	57	1.654
7.	J. Appl. Phys.	12828	3364	26.2	21096	60.8	81	1.936
8.	Sov. Phys. Sol. St.	9612	4456	46.4	10420	92.2	38	2.046
9.	Nuovo Cimento	8692	1848	21.3	9768	89.0	42	0.527
10.	P. Roy. Soc. Lond.	7228	412	5.7	19156	37.7	91	2.998
11.	J. Physics	7196	1532	21.2	12724	56.6	68	1.405
12.	Zschr. Physik	5556	760	13.7	7036	79.0	74	1.536
13.	J. Phys. Soc. Japan	5236	1308	25.0	6932	75.5	58	1.045
*14.	J. Amer. Chem. Soc.	5044			105228	4.8	40	5.859
15.	Acta Cryst.	4748	2788	58.7	11588	41.0	34	2.469
16.	Philosophical Mag.	4616	644	14.0	7696	60.0	63	2.251
17.	Rev. Mod. Phys.	4232	20	0.5	5412	78.2	65	4.508
18.	J. Phys. Chem. Sol.	4092	276	6.7	5676	72.1	47	2.073
19.	Phys. Stat. Sol.	4056	1960	48.3	5252	77.2	39	1.578
20.	Comptes Rendus	3928	1752	44.6	21888	17.9	49	0.780
21.	Phys. Fluids	3556	1224	34.4	5176	68.7	33	1.581
22.	Ann Physics	3368	144	4.3	4384	76.8	56	3.188
23.	Canad. J. Phys.	3312	596	18.0	5292	62.6	54	2.186
*24.	J. Phys. Chem.	3240			18712	17.3	32	2.429
25.	Opt. Spectr. USSR	3096	1832	59.2	4200	73.7	25	1.331
26.	Appl. Phys. Lett	3092	576	18.6	5272	58.6	34	3.688
27.	J. Math. Phys.	3056	876	28.7	3792	80.5	42	0.492
28.	B. Amer. Phys. Soc.	3016	324	10.7	3532	85.4	34	0.156
29.	Physica	3016	552	18.3	3796	79.5	53	1.755
30.	Prog. Theor. Phys.	2956	1312	44.4	3348	88.3	31	1.513
31.	T. Faraday Soc.	2908	1056	36.3	11644	25.0	30	2.149
32.	Nucl. Instr. Meth.	2752	1468	53.3	3276	84.0	29	1.016
33.	JETP Lett.	2748	920	33.5	3024	90.9	22	2.240
34.	Sov. Phys. Tech. Phys.	2728	1524	55.9	3648	74.8	26	1.322
35.	Sov. J. Nucl. Phys.	2712	1852	68.3	2936	92.4	14	2.054
*36.	J. Chem. Soc.	2516	–	–	55912	4.5	24	3.123
37.	J. Opt. Soc. Amer.	2464	1016	41.2	6316	39.0	35	0.962
*38.	Nature	2452	–	–	61240	4.0	66	2.244
39.	Zschr. Naturforsch.	2452	1228	50.1	8716	28.1	47	1.433
*40.	Astrophys. J.	2260	–	–	17032	13.3	28	4.972
*41.	Dokl. Akad. Nauk USSR	2068	–	–	12404	16.7	42	0.572
*42.	Rev. Sci. Instr.	1928	–	–	4892	39.4	39	0.868
*43.	Acta Metallurg.	1804	–	–	5216	26.9	24	2.278
44.	Nucl. Sci. Eng.	1784	660	37.0	1940	92.0	15	1.290
45.	Sov. Phys. Usp.	1716	412	24.0	2536	67.7	19	4.930
46.	J. Fluid Mech.	1612	972	60.3	3848	41.9	20	2.376
47.	J. Polym. Sci.	1528	1016	66.5	11572	13.2	7	1.039
48.	Sov. Phys. Semicond.	1436	1012	70.5	1548	92.8	13	1.741
49.	Izv. Akad Nauk Fiz.	1404	560	39.9	1800	78.0	17	0.807
50.	J. Inorg. Nucl. Chem.	1380	836	60.6	5540	24.9	17	1.535

Figure 9.36 Fifty journals cited most frequently by 188 physics journals. Those not marked with an asterisk are one of the 188.

50 journals cited most often by the 188 journals listed in the 1969 *SCI* in the categories of *physics* and *nuclear science and technology*. The results are shown in Figure 9.36. Except for the big three of *Physical Review, Journal of Chemical Physics,* and *Physical Review Letters,* the ranking of the journals on this list differed considerably from the lists developed by Inhaber from a data base of multidisciplinary sources. The list also includes eight journals not categorized as physics journals in the *SCI.*

The second analytical approach used was to rank the top 50 physics journals by the percent of total citations accounted for by references from the 188 physics journals used as the source data base. The results of that analysis are shown in Figure 9.37. One of the interesting features of this list was the identification of a number of journals that do not contain the words "physics" or "nuclear" in their title, and that probably would not be classified as physics journals in one or another of the compendiums of scientific journals but that were an important part of the physics literature to the extent that more than 50% of the citations they received came from physics journals.

An interesting feature of both lists is that Soviet physics journals ranked high on them. Another characteristic of both lists demonstrates the danger of treating citation data as an absolute measure of quality. Chen reported (22) that *Physics Today, Science,* and *Nature* ranked among the 13 journals most "important" to physicists. Neither list contained *Physics Today. Nature* did appear on the first list (Figure 9.36), but ranked only thirty-eighth, compared with Chen's ranking of thirteenth. It did not appear on the second list (Figure 9.37) at all. *Science* did not show up on either list, though it would have ranked among the second 50 most cited journals if we had extended the first list to the top 100. The words "importance" and "quality" are multifaceted words, and citation data measures only one of their facets.

Cancer Research (23)

A study of 16 cancer journals provided hard data to support the position that applied research in the area of cancer depends heavily on basic, noncancer research. The data came from a citation analysis of a list of core cancer journals suggested by the National Cancer Institute:

- *Bulletin du Cancer*
- *British Journal of Cancer*
- *British Journal of Experimental Pathology*
- *Cancer Chemotherapy Reports*
- *Cancer*
- *Cancer Research*
- *European Journal of Cancer*
- *Gann*
- *International Journal of Cancer*
- *Journal of the National Cancer Institute*
- *National Cancer Institute Monograph*
- *Neoplasma*

	Journal	'Physical' Citations A	Self-Citations B	Self-Citation Rate (B/A)	Total Citations D	'Physical' Citation Rate (A/D)	Number of Physics Journals Citing	Impact Factor
1.	Nucl. Phys (4)	15544	6012	38.7	16044	96.8	46	0.858
2.	Sov. Phys. Semicond. (48)	1436	1012	70.5	1548	92.8	13	1.741
3.	T. Amer. Nucl. Soc. (56)	1168	884	75.7	1260	92.7	9	0.388
4.	Sov. J. Nucl. Phys. (35)	2712	1852	68.3	2936	92.4	14	2.054
5.	Sov. Phys. Sol. St. (8)	9612	4456	46.4	10420	92.2	38	2.046
6.	Nucl. Sci. Eng. (44)	1784	660	37.0	1940	92.0	15	1.290
7.	Phys. Lett. (6)	14320	1568	10.9	15740	91.0	57	1.654
8.	Phys. Rev. Lett. (3)	23792	2432	10.2	26176	90.9	77	5.114
9.	JETP Lett. (33)	2748	920	33.5	3024	90.9	22	2.240
10.	Sov. Phys. JETP (5)	15196	4564	30.0	16852	90.2	63	3.944
11.	Phys. Rev. (1)	74224	17808	24.0	82664	89.8	113	3.679
12.	Nuovo Cimento (9)	8692	1848	21.3	9768	89.0	42	0.527
13.	Prog. Theor. Phys. (30)	2956	1312	44.4	3348	88.3	31	1.513
14.	B. Amer. Phys. Soc. (28)	3016	324	10.7	3532	85.4	34	0.156
15.	Nucl. Instr. Meth. (32)	2752	1468	53.3	3276	84.0	29	1.016
16.	J. Math. Phys. (27)	3056	876	28.7	3792	80.5	42	0.492
17.	Phys. Kondens. Mater. (101)	348	128	36.8	436	79.8	8	2.580
18.	Sol. St. Comm. (55)	1168	264	22.6	1468	79.6	20	1.189
19.	Physica (29)	3016	552	18.3	3796	79.5	53	1.755
20.	Zschr. Physik (12)	5556	760	13.7	7036	79.0	74	1.536
21.	Rev. Mod. Phys. (17)	4232	20	0.5	5412	78.2	65	4.508
22.	Izv. Akad. Nauk. Fiz (49)	1404	560	39.9	1800	78.0	17	0.807
23.	Ann. Rev. Nucl. Sci. (91)	480	116	24.2	616	77.9	12	5.629
24.	Phys. Stat. Sol. (19)	4056	1960	48.3	5252	77.2	39	1.578
25.	Ann. Physics (22)	3368	144	4.3	4384	76.8	56	3.188
26.	Helv. Phys. Acta (65)	932	40	4.3	1216	76.6	31	0.559
27.	J. Phys. Soc. Japan (13)	5236	1308	25.0	6932	75.5	58	1.045
28.	Sov. Phys. Tech. Phys. (34)	2728	1524	55.9	3648	74.8	26	1.322
29.	Opt. Spectr USSR (25)	3096	1832	59.2	4200	73.7	25	1.331
30.	IEEE T. Nucl. Sci. (73)	736	256	34.8	1016	72.4	9	0.722
31.	J. Phys. Chem. Sol. (18)	4092	276	6.7	5676	72.1	47	2.073
32.	Sol. St. Phys. (64)	992	–	–	1388	71.5	24	16.285
33.	Ark. Fiz. (53)	1172	384	32.7	1660	70.6	19	0.993
34.	Surface Sci. (61)	1104	584	52.9	1592	69.3	16	2.982
35.	J. Nucl. Mater. (66)	908	536	59.0	1312	69.2	8	1.398
36.	Phys. Fluids (21)	3556	1224	34.4	5176	68.7	33	1.581
37.	Sov. Phys. USP (45)	1716	412	24.0	2536	67.7	19	4.930
38.	Adv. Phys. (70)	786	0	–	1168	67.3	19	3.857
39.	Phys. Metal. Met. USSR (51)	1236	640	51.8	1912	64.6	13	0.872
40.	Canad. J. Phys. (23)	3312	596	18.0	5292	62.6	54	2.186
41.	J. Appl. Phys. (7)	12828	3364	26.2	21096	60.8	81	1.936
42.	Comm. Math. Phys. (97)	448	344	76.8	744	60.2	10	7.593
43.	Philosophical Mag. (16)	4616	644	14.0	7696	60.0	63	2.251
44.	Sov. Phys. Cryst. (60)	1108	588	53.1	1872	59.2	14	1.339
45.	Appl. Phys. Lett (26)	3092	576	18.6	5272	58.6	34	3.688
46.	J. Physics (11)	7196	1532	21.2	12724	56.6	68	1.405
47.	Zschr. Angew. Phys. (75)	716	256	35.8	1276	56.1	12	0.817
48.	Amer. J. Phys. (96)	452	276	61.1	840	53.8	8	0.298
49.	IEEE J. Quant. Elect. (80)	664	244	36.7	1284	51.7	12	1.303
50.	J. Physique (74)	724	184	25.4	1412	51.3	19	0.391

Figure 9.37 Fifty journals ranked by ratio of citations received from 188 physics journals to citations received from all sources. Numbers in parentheses following the journal titles show ranking in Figure 9.36.

- *Proceedings of the American Association for Cancer Research*
- *Progress in Experimental Tumor Research*
- *Tumori*
- *Zeitschrift fur Krebsforschung*

The analysis consisted of compiling lists of the 50 journals cited most frequently by this core group (Figure 9.38), and the 50 journals that are the major sources of citations to the core group (Figure 9.39). The lists show the following for each journal:

1. Total citations to or from all scientific journals.
2. Citations to or from the core group of cancer journals ("Cancer Citations").
3. Cancer citations as a percent of total citations.
4. Impact factor based on total citations.
5. Impact factor based only on cancer citations ("Cancer Impact").
6. Ratio between total impact and cancer impact.

This last figure is a particularly revealing one because it is a measure of the strength of a journal's cancer orientation. For example, *Neoplasma* in Figure 9.38 was cited only 192 times, which gave it a total impact factor of 0.638. However, 124 of the references that cited it came from the core cancer journals, so its cancer impact was 0.555. The ratio of the two impact figures is 87.0, which is an indication of a very strong cancer orientation. In contrast, the *British Journal of Experimental Pathology* was cited a total of 2420 times, but only 184 times by the cancer journals. While its general impact was 1.476, its cancer impact was only 0.134, and the ratio between the two was only 9.1. When compared with the impact ratios of the other core journals or even some of the journals outside the core (the *Journal of Invertebrate Pathology,* for example, had an impact ratio of 21.1), it is hard to see why it was included on the list of core cancer journals.

The listing of journals that cited the cancer journals (Figure 9.39) shows the core group bunched near the top, indicating a lot of interaction between them. The listing of journals cited by the core group (Figure 9.38), however, shows quite a different story. The core group was cited no more frequently than the basic research journals. As a matter of fact, the citation statistics show they were cited less frequently. Fifty-eight percent of the references in the core group cited basic-research journals.

Another fact underlined by the two lists is that the cancer literature is dominated by three journals: *Cancer, Cancer Research,* and the *Journal of the National Cancer Institute.*

Botany (24)

A study of the botany literature produced the lists shown in Figures 9.40 and 9.41 of the journals that cited and were cited by a core group of botany journals most often. The core group that formed the data base for the analysis was somewhat arbitrary, consisting of the journals categorized as botany journals in the 1969 *SCI,* but not the journals in related subject categories, such as agriculture, agronomy, and ecology.

Figure 9.40 shows the journals that cited the core group most frequently. Of the approximately 14,500 citations received by the core group, 68% came from these 50 journals. *Annual Review of Phytopathology,* and *Botanical Review* ranked second

	Journal	Total Citations (A)		(B/A)	Overall Impact (C)	Cancer Impact (D)	Impact Ratio (D/C) x 100
*1.	*Cancer Res.*	9772		34.5	3.084	1.105	35.9
*2.	*J. Nat. Cancer Inst.*	6604		41.7	4.400	2.105	47.8
*3.	*Cancer*	5656		26.3	2.162	0.594	27.4
*4.	Nature	61240		2.3	2.244	0.050	2.2
*5.	P. Soc. Exp. Biol. Med.	20044		4.3	1.964	0.118	6.1
*6.	Science	38956		2.2	2.894	0.048	1.7
*7.	*Brit. J. Cancer*	1860		43.2	1.670	0.722	43.2
*8.	J. Biol. Chem.	68012		1.2	6.371	0.054	0.8
*9.	Ann. New York Acad. Sci.	15024		4.1	1.815	0.003	0.2
*10.	Lancet	30448		2.0	1.509	0.001	0.1
*11.	J. Amer. Med. Assoc.	17952		3.3	1.027	0.041	4.0
12.	J. Exp. Med.	15432		3.4	9.030	0.227	2.5
13.	P. Nat. Acad. Sci. USA	32824		1.6	1.308	0.095	7.2
14.	J. Cell Biol.	19076		2.5	3.484	0.076	2.2
*15.	New Engl. J. Med.	18096		2.5	2.453	0.069	2.8
*16.	Amer. J. Pathol.	5740		7.5	1.916	0.152	7.9
*17.	*Internat. J. Cancer*	1088		39.3	2.533	1.062	41.9
18.	Virology	9492		4.1	4.720	0.195	4.1
*19.	Surg. Gyn. Obst.	5468		6.9	1.578	0.087	5.5
20.	J. Med. Microbiol.	3952		9.4	20.000	1.600	8.0
*21.	*Nat. Cancer Inst. Mon.*	576		64.6	0.738	1.235	169.2
*22.	Biochim. Biophys. Acta	38000		1.0	3.287	0.029	0.9
*23.	Fed. Proc.	13364		2.7	0.568	0.135	2.4
*24.	Exp. Cell. Res.	7528		4.6	2.273	0.081	3.6
25.	Biochem. J.	30500		1.0	3.193	0.030	0.9
*26.	*Gann*	620		47.1	0.874	0.318	36.4
27.	Blood	6444		4.5	2.867	0.138	4.8
28.	*P. Amer. Assoc. Cancer Res.*	864		33.3	0.421	0.174	41.3
29.	Brit. Med. J.	17156		1.7	0.778	0.006	0.7
30.	Lab. Invest.	3668		7.4	2.008	0.130	6.5
31.	Ann. Surg.	6504		4.1	1.665	0.077	4.6
*32.	*Zschr. Krebsforschung*	664		38.6	1.212	0.394	32.5
*33.	Arch. Pathol.	4496		5.5	1.509	0.055	3.7
34.	Amer. J. Med.	8752		2.5	4.694	0.158	3.4
35.	Comptes Rendus.	21888		0.9	0.780	0.007	1.0
*36.	*Brit. J. Exp. Pathol.*	2420		7.6	1.476	0.134	9.1
*37.	J. Immunology	10492		1.7	4.305	0.109	2.5
38.	Amer. J. Roentgenol.	4976		3.2	1.257	0.024	1.9
39.	J. Amer. Vet. Med. Ass.	1924		8.1	0.488	0.038	8.5
*40.	*Eur. J. Cancer*	420		75.7	2.027	1.609	79.4
*41.	Transplantation	2036		7.1	3.164	0.228	7.2
*42.	*Cancer Chemother. Rep.*	796		17.6	1.206	0.229	19.0
*43.	Radiology	4700		3.0	1.533	0.035	2.3
*44.	Brit. J. Surg.	2356		5.8	0.506	0.005	0.9
45.	J. Histochem. Cytochem.	4892		2.8	2.442	0.012	0.3
46.	Ann. Internal Med.	7728		1.7	1.640	0.021	1.4
47.	Anat. Rec.	5416		2.3	0.423	0.002	0.1
*48.	J. Clin. Invest.	19116		0.6	3.461	0.004	0.1
49.	J. Invert. Pathol.	924		13.4	1.194	0.252	21.1
*50.	*Neoplasma*	192		64.5	0.638	0.555	87.0
*86.	*Prog. Exp. Tumor Res.*	192		45.8	2.400	1.067	44.4
*87.	*B. Cancer*	228		38.5	0.413	0.310	75.1
*113.	*Tumori*	124		35.5	0.238	0.119	50.2

Figure 9.38 Journals cited most frequently by 16 cancer journals. Italicized titles identify the 16 cancer journals. Asterisks identify journals that are also major sources of references to the 16 cancer journals.

	Journal	Total Citations (A)		(B/A)	Impact Factor	Self-Citing Rate	Self-Cited Rate
*1.	*J. Nat. Cancer Inst.*	7004		28.8	4.400	37.9	51.8
*2.	*Cancer Res.*	7056		26.7	3.084	33.5	55.9
*3.	*Nat. Cancer Inst. Mon.*	10208		16.0	2.673	48.6	17.1
*4.	*Cancer*	7484		29.8	2.162	57.3	57.6
*5.	*Eur. J. Cancer*	2804		26.8	2.027	75.7	14.9
6.	Sem. Hematol.	1472		49.7	3.916		
*7.	*Progr. Exp. Tumor Res.*	2708		26.7	2.400	45.8	2.8
*8.	Proc. Soc. Exp. Biol. Med.	19604		3.3	1.964		
*9.	Ann. New York Acad. Sci.	41844		10.3	1.815		
*10.	*Brit. J. Cancer*	1820		28.6	1.670	21.4	41.3
*11.	*Internat. J. Cancer*	1204		34.5	2.533	29.0	29.8
*12.	Fed. Proc.	6712		6.1	0.568		
*13.	*Neoplasma*	2248		18.0	0.638	100.0	30.7
*14.	*Gann*	1420		27.6	0.874	41.1	30.6
*15.	Exp. Cell Res.	7756		4.7	2.273		
16.	Acta Path. Scand.	6940		4.6	1.009		
*17.	Lancet	17636		1.7	1.509		
18.	Amer. J. Surg.	7496		4.1	0.992		
19.	Acta Cytol.	2292		12.0	1.046		
20.	Arch. Geschw.	1296		21.3	0.500		
21.	Molec. Pharmacol.	2656		9.9	4.028		
*22.	J. Immunol.	12084		2.1	4.305		
*23.	*Zschr. Krebsforschung*	1256		19.7	1.212	34.3	35.5
*24.	Transplantation	5068		4.7	3.164		
*25.	Biochim. Biophys. Acta	41076		0.6	3.287		
*26.	*Brit. J. Exp. Pathol.*	2168		10.1	1.476	93.5	78.2
*27.	Nature	27108		0.8	2.244		
*28.	New Engl. J. Med.	14064		1.5	2.453		
*29.	Science	22796		3.5	2.894		
*30.	Arch. Pathol.	3576		5.0	1.509		
*31.	*Cancer Chemother. Rep.*	380		46.3	1.206	74.3	59.1
*32.	J. Biol. Chem.	34636		0.5	6.371		
33.	Path. Biol.	4308		3.7	0.722		
34.	Virch. Arch. B.	2628		5.9	1.066		
*35.	Brit. J. Surg.	2692		5.6	0.506		
36.	Rev. Fr. Clin.	2132		7.1			
37.	J. Pathology	4404		3.6	0.037		
38.	Exp. Mol. Path.	2204		6.4	1.948		
39.	Acta Med. Oka.	2580		5.0	1.400		
40.	J. Neurosurg.	4576		2.8	1.320		
41.	Klin. Wschr.	9844		1.3	0.723		
*42.	Radiology	8444		1.4	1.533		
*43.	J. Amer. Med. Assoc.	8266		1.4	1.027		
*44.	Amer. J. Pathol.	3716		3.0	1.916		
*45.	Surg. Gyn. Obst.	3680		2.8	1.578		
46.	Amer. J. Clin. Path.	3384		3.0	0.623		
47.	Deut. Med. Wschr.	16052		0.6	0.675		
*48.	J. Clin. Invest.	9160		1.1	3.461		
49.	Amer. J. Obst. Gyn.	10948		0.9	1.269		
50.	Med. J. Australia	6396		1.5	0.501		
*101.	*B. Cancer*	936		8.1	0.413	38.5	
*123.	*Tumori*	284		11.3	0.238	35.5	37.5

Figure 9.39 Major sources of references to 16 cancer journals. Italicized titles identify most of the 16 cancer journals. Asterisks identify journals that are also frequently cited by the 16 cancer journals.

and seventh, respectively, despite very low self-citation rates. The appearance of only one genetics journal—*Theoretical and Applied Genetics*, #33—seemed somewhat surprising.

The journals cited most frequently by the core group are shown in Figure 9.41. Of the approximately 17,700 references published by the core group, 59% of them cited

	Journal	A	B	C	D	E	F	G
1.	Phytopathology	2830	1399	822	49.4	29.1	58.8	1.078
2.	Annu. Rev. Phytopath.	2181	740	30	33.9	1.4	4.1	4.914
3.	Planta	1085	460	123	42.4	11.3	26.7	2.944
4.	Plant Physiology	960	369	200	38.4	20.8	54.2	1.683
5.	Plant Cell Physiol.	820	318	75	38.8	9.2	23.6	1.785
6.	Canad. J. Botany	768	312	62	40.6	8.1	19.9	1.217
7.	Botan. Rev.	772	260	6	33.7	0.8	2.3	3.818
8.	Phytochemistry	1473	258	153	17.5	10.4	59.3	1.907
9.	J. Am. Soc. Hort. Sci.	755	256	175	33.9	23.2	68.4	0.392
10.	Weed Sci.	564	255	171	45.2	30.3	67.1	1.568
11.	Amer. J. Botany	590	226	73	38.3	12.4	32.3	0.956
12.	Comptes Rendus D	3784	220	–	5.8	–	–	0.780
13.	Ecology	991	215	118	21.6	11.9	55.3	1.256
14.	Mycopath. Mycol. Appl.	2831	214	80	7.6	2.8	37.4	0.346
15.	T. Brit. Mycol. Soc.	549	212	73	38.6	13.3	34.4	0.830
16.	New Phytologist	579	210	54	36.3	9.3	25.7	1.382
17.	Agron. J.	1008	196	–	19.4	–	–	0.947
18.	J. Exp. Botany	434	191	63	44.0	14.5	33.0	2.400
19.	Physiol. Plantarum	486	185	52	38.1	10.7	28.1	1.796
20.	Protoplasma	965	184	60	19.1	6.2	32.6	2.183
21.	Plant Soil	820	177	52	21.6	6.3	29.4	0.988
22.	Soil Sci. Soc. Am. P.	608	177	112	29.1	18.4	63.3	0.867
23.	Mycologia	444	163	51	36.7	11.5	31.3	0.901
24.	Weed Res.	467	155	28	33.2	6.0	18.1	0.837
25.	Soil Sci.	405	141	61	34.8	15.1	43.3	0.923
26.	Forest Chron.	485	137	29	28.3	6.0	21.2	–
27.	Indian J. Agr. Sci.	959	129	–	13.5	–	–	0.334
28.	Zeit. Pflanzenphysiol.	414	124	24	30.0	5.8	19.4	1.048
29.	Phyton	364	115	12	31.6	3.3	10.4	0.103
30.	Ann. Amelior. Plant.	323	110	11	34.1	3.4	10.0	0.428
31.	Oesterr. Bot. Zschr.	370	110	55	29.7	14.9	50.0	–
32.	Ann. Botany	242	100	30	41.3	12.4	30.0	1.443
33.	Theor. Appl. Gen.	776	100	–	12.9	–	–	–
34.	Ber. Deut. Bot. Ges.	669	99	20	14.8	2.9	20.2	0.519
35.	Acta Bot. Neerl.	372	98	22	26.3	5.9	22.4	0.535
36.	Austr. J. Botany	266	98	24	36.8	9.0	24.5	0.297
37.	Bull. Torrey Bot. Club	366	98	13	26.8	3.6	13.3	0.623
38.	Dokl. Akad. Nauk SSSR	7647	94	–	1.2	–	–	0.572
39.	Crop Sci.	620	93	–	15.0	–	–	0.712
40.	J. Soil Sci.	302	89	27	29.5	8.9	30.3	0.861
41.	Acta Biol. Crac. Bot.	378	88	27	23.3	7.1	30.7	1.411
42.	Austr. J. Biol. Sci.	1245	88	–	7.1	–	–	1.957
43.	Ann. Appl. Biol.	431	87	67	20.2	15.5	77.0	1.386
44.	Bioch. Bioph. Acta	10269	87	–	0.9	–	–	3.287
45.	Arch. Mikrobiol.	1318	83	–	6.3	–	–	2.120
46.	Naturwissenschaften	1574	82	–	5.2	–	–	0.920
47.	Zschr. Pflanzenzucht.	418	80	21	19.1	5.0	26.3	0.271
48.	Qual. Plant. Mat. Veg.	726	74	25	10.2	3.4	33.8	0.115
49.	Biol. Plant.	299	73	29	24.4	9.7	39.7	0.396
50.	Holz. Roh. Werkst.	244	72	51	29.5	20.9	70.8	0.437

Figure 9.40 Major sources of references to botany journals. A = references to all journals. B = references to botany journals. C = references to self. D = ration of botany references to all references. E = ration of self-citations to all references (self-citing rate). F = ratio of self-citations to botany references. G = overall impact.

material in these 50 journals. Many of the highly cited journals are the same ones that appeared on lists generated in analyses of other fields. *Nature* and *Science* ranked fourth and sixth, respectively. *Virology* ranked twenty-ninth. An unexpected, but interesting, entry was *American Review of Respiratory Diseases.* It owes its place on the list solely to *Mycopathologia et Mycologia Applicata,* which cited it

	Journal	A	B	C	D	E	F	G
1.	Phytopathology	1713	1305	822	76.2	48.0	63.0	1.078
2.	Plant Physiology	1639	961	200	58.6	12.2	20.8	1.683
3.	Amer. J. Botany	1171	647	73	55.3	6.2	11.3	0.956
4.	Nature	15310	578	–	3.9	–	–	2.244
5.	Planta	707	384	123	54.3	17.4	32.0	2.944
6.	Science	9739	319	–	3.3	–	–	2.894
7.	J. Biol. Chem.	17103	315	–	1.8	–	–	6.371
8.	Canad. J. Botany	548	292	62	53.3	11.3	21.2	1.217
9.	Bioch. Bioph. Acta	9500	284	–	3.0	–	–	3.287
10.	Physiol. Plantarum	482	269	52	55.8	10.8	19.3	1.796
11.	J. Am. Soc. Hort. Sci.	357	247	175	69.2	49.0	70.9	0.392
12.	Phytochemistry	588	247	153	42.0	26.0	61.9	1.907
13.	Biochem. J.	7625	231	–	3.0	–	–	3.193
14.	Weed Sci.	311	223	171	71.7	55.0	76.7	1.568
15.	Ann. Botany	424	215	30	50.7	7.1	14.0	1.443
16.	Plant Dis. Rep.	286	205	–	71.7	–	–	0.268
17.	J. Exp. Botany	337	200	63	59.4	18.7	31.5	2.400
18.	Ecology	577	193	118	33.5	20.5	61.1	1.256
19.	Bot Gaz.	312	186	9	59.6	2.9	4.8	0.658
20.	P. Nat. Acad. Sci. USA	8206	164	–	2.0	–	–	8.828
21.	New Phytologist	295	159	54	53.9	18.3	34.0	1.382
22.	Annu. Rev. Pl. Phys.	290	154	0	53.1	0.0	0.0	7.047
23.	Mycologia	302	148	51	49.0	16.9	34.5	0.901
24.	J. Bacteriology	4138	146	–	3.5	–	–	3.594
25.	J. Cell Biol.	4769	145	–	3.0	–	–	3.484
26.	Agron. J.	727	143	–	19.7	–	–	0.947
27.	Soil Sci.	629	136	61	21.6	9.7	44.9	0.923
28.	Arch. Bioch. Bioph.	3647	135	–	3.7	–	–	3.519
29.	Virology	2373	124	–	5.2	–	–	4.720
30.	Austr. J. Biol. Sci.	583	116	–	19.9	–	–	1.957
31.	Ann. Appl. Biol.	453	113	67	24.9	14.8	59.3	1.386
32.	Comptes Rendus	5472	110	–	2.0	–	–	0.780
33.	Plant Cell Physiol.	203	108	75	53.2	37.0	69.4	1.785
34.	J. Agr. Res.	267	101	–	37.8	–	–	–
35.	T. Brit. Mycol. Soc.	263	97	73	36.9	27.8	75.3	0.830
36.	Amer. Rev. Resp. Dis.	874	93	–	10.6	–	–	0.834
37.	Crop. Sci.	353	88	–	24.9	–	–	0.712
38.	J. Chem. Soc.	13978	85	–	0.6	–	–	3.123
39.	Protoplasma	299	85	60	28.4	20.1	70.6	2.183
40.	J. Amer. Chem. Soc.	26307	82	–	0.3	–	–	5.859
41.	Mycopath. Mycol. Appl.	120	80	80	66.7	66.7	100.0	0.346
42.	Ber. Deut. Bot. Ges.	175	76	20	43.4	11.4	26.3	0.519
43.	Annu. Rev. Phytopath.	108	74	30	68.5	27.8	40.5	4.914
44.	Bioch. Biophys. Res.	3404	70	–	2.1	–	–	4.468
45.	Plant Soil	202	68	52	33.7	25.7	76.5	0.988
46.	J. Ecology	156	67	–	43.0	–	–	0.421
47.	J. Forestry	150	66	35	44.0	23.3	53.0	0.197
48.	J. Gen. Microbiol.	1438	65	–	4.5	–	–	2.337
49.	Holz. Roh. Werkst.	123	65	51	53.0	41.5	78.5	0.437
50.	Botan. Rev.	160	64	6	40.0	3.8	9.4	3.818

Figure 9.41 Journals cited most frequently by botany journals. A = citations from all journals. B = citations from botany journals. C = self-citations. D = ratio of botany citations to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self- citations to botany citations. G = overall impact.

frequently. Despite the availability of an English translation of the botanical section of the *Doklady Akademii Nauk USSR,* that journal was not cited frequently enough to appear on the list. It would have ranked in about one hundred thirtieth on an extended list.

Figure 9.42 shows the journals that are common to both lists. They are ranked by botanical impact, which is the citation rate of the average article when only citations from the core journals are considered. The important journal *Botanical Gazette* did not appear on this list only because it did not cite the core journals frequently enough to be included in Figure 9.40.

	Journal	
1.	Annu. Rev. Phytopath.	251.6
2.	Botan. Rev.	182.0
3.	Planta	182.0
4.	J. Exp. Botany	122.8
5.	Weed Sci.	105.6
6.	Physiol. Plantarum	98.4
7.	Plant Cell Physiol.	97.6
8.	Plant Physiology	96.4
9.	Phytopathology	86.8
10.	New Phytologist	85.2
11.	Canad. J. Botany	72.4
12.	Phytochemistry	70.4
13.	Ann. Botany	63.2
14.	Protoplasma	62.0
15.	Amer. J. Botany	53.6
16.	Ecology	52.8
17.	Mycologia	43.6
18.	Austr. J. Biol. Sci.	40.4
19.	J. Am. Soc. Hort. Sci.	39.2
20.	Ann. Appl. Biol.	31.6
21.	Soil Sci.	28.0
22.	Plant Soil	27.6
23.	T. Brit. Mycol. Soc.	27.2
24.	Holz. Roh. Werkst.	26.0
25.	Agron. J.	24.0
26.	Ber. Deut. Bot. Ges	20.4
27.	Mycopath. Mycol. Appl.	16.8
28.	Crop Sci.	13.2
29.	Bioch. Bioph. Acta	10.8
30.	Comptes Rendus	1.2

Figure 9.42 Journals common to both Figure 9.40 and Figure 9.41, ranked by "botanical impact."

Psychology and Behavioral Science (25)

A study of the literature of psychology and behavioral science produced the results shown in Figures 9.43, 9.44, and 9.45. The data base used for this study consisted of the 77 core journals that are listed in the 1969 *SCI* as belonging to the overlapping subject areas but that did not include in their titles the word "psychiatry" or other clinical terms.

Figure 9.43 shows the top 50 sources of citations to the core journals. These journals accounted for 89% of all the citations received by the core journals. Forty-two of these source journals were members of the core group. The eight that were not, but that cited the core group heavily, are identified by italics. One of them was *Science,* which ranked thirty-seventh. Another was the *Annals of the New York Academy of Sciences,* which ranked seventh. Its appearance probably was an accident of the small data sample used (only a quarter of a year). It frequently devotes an entire issue to a single topic, and the citations from such an issue would loom large enough in a small data sample to exaggerate the relationship between the *Annals* and the subject. Unlike *Science, Nature* did not show up on the top 50, but would have ranked about sixty-fifth on a longer list of major citation sources.

The self-citing rate of the core-group journals in Figure 9.43 is interesting when compared to the botany journals in the earlier study. The average self-citing rate for the botany journals was 34%, whereas the average for the psychology journals was only 11%. However, the situation was reversed when each group of journals was treated in aggregate. When the self-citations of all the psychology journals were added together and divided by the total references published by all of them, the self-citing rate of psychology journals soared to 27%. In contrast, the comparable figure for the botany journals dropped to 11%. The most likely explanation for this turnabout is that the high average self-citing rate of the botany journals reflected the existence of a number of subspecialties served by narrowly focused journals. Either psychology did not have a comparable set of subspecialties or, if it did, they had not yet spawned as many highly specialized journals.

Another interesting feature of Figure 9.43 was the absence of psychiatric journals. The only near exception was the *Archives of General Psychiatry,* whose 41 citations to the core group put it just outside the top 50. No other psychiatric journal cited the core group even that many times; four, in fact, was the highest citation rate. Even journals in audiology and acoustics showed a closer relationship to psychology than that. Though the functional distance between psychology and psychiatry may not be news to those in the field, it is certainly not what people outside the field would expect.

Figure 9.44 shows the journals that were most frequently cited by the core group. Most of them (35 of the 50) appeared on the list of major citation sources as well. Those unique to the highly cited list were either psychology journals or journals concerned with subjects related to psychology. Again, *Science* and *Nature* showed up as important sources of psychology material. The 50 journals in this figure accounted for 77% of all the material cited by the core group during the period studied.

Figure 9.45 shows the 50 journals that had the highest psychology impact ratings, which are based only on citations received from the core group of psychology journals. The interesting thing about this list is that the ranking of the journals was quite close to the way they would be ranked if the total impact factors shown for them in Figures 9.43 and 9.44 had been used. This suggests to me that psychology is characterized by a high degree of parochialism. I would not go so far as to say that psychologists and behavioral scientists are not very open to outside influences, but they do not seem to have much to do with the rest of the research world. If they do,

Journal	A	B	C	D	E	F	G
1. *J. Exp. Psychol.	1482	**1005**	400	67.8	27.0	39.8	1.867
2. *Psychonomic Science	1497	**907**	154	60.6	10.3	17.0	0.616
3. *J. Comp. Phys. Psych.	1208	**616**	298	51.0	24.7	48.4	1.938
4. *Psychol. Reports	1252	**597**	81	46.3	6.5	14.0	0.409
5. *Perc. Motor Skills	1247	**510**	108	40.9	8.7	21.2	0.438
6. *J. Exp. Anal. Behav.	594	**404**	255	68.0	42.9	63.1	2.395
7. *Ann. N.Y. Acad. Sci.*	10461	**376**	—	3.6	—	—	1.815
8. *J. Pers. Soc. Psych.	701	**370**	163	52.8	23.3	44.1	1.698
9. *Psychol. Bull.	672	**347**	21	51.6	3.1	6.1	3.081
10. *Physiol. Behav.	1032	**305**	48	30.0	4.7	15.7	1.496
11. *J. Cons. Clin. Psych.	718	**273**	61	38.0	8.5	22.3	1.217
12. *Psychol. Rev.	438	**266**	15	60.7	3.4	5.6	4.433
13. Annee Psychologique	573	**241**	11	42.1	1.9	4.6	0.065
14. *J. General Psych.	421	**232**	5	55.1	1.2	2.2	0.259
15. *Psychophysiology	451	**184**	63	40.8	4.0	34.2	0.723
16. *Behav. Res. Ther.	386	**180**	68	46.6	17.6	37.8	1.504
17. *J. Personality	389	**174**	32	44.7	8.2	18.4	0.761
18. *Perc. Psychophys.	333	**168**	41	50.5	12.3	24.4	0.991
19. *J. Verb. Learn. Beh.	265	**166**	45	62.6	17.0	27.1	1.374
20. *J. Abnormal Psych.	423	**165**	28	39.0	6.6	17.0	1.586
21. Acta Psychologica	369	**164**	—	44.4	—	—	1.345
22. Brit. J. S&C Psych.	381	**163**	8	42.8	2.1	14.9	—
23. *J. Soc. Psychol.	376	**151**	25	40.2	6.7	16.6	0.433
24. *J. Couns. Psychol.	328	**125**	57	38.1	17.4	45.6	—
25. *J. Educ. Psychol.	339	**124**	39	36.6	11.5	31.5	1.044
26. J. Clin. Psychol.	294	**117**	40	39.8	13.6	34.2	0.367
27. *J. Genetic Psychol.	373	**115**	15	30.8	4.0	13.0	0.148
28. J. Exp. Child Psych.	237	**106**	13	44.7	5.5	12.3	0.403
29. *Amer. Psychologist	395	**94**	38	40.4	9.6	40.4	0.331
30. *J. Nerv. Ment. Dis.*	561	**94**	—	16.8	—	—	0.707
31. *Behaviour	419	**90**	39	21.5	9.3	43.3	1.294
32. *Educ. Psych. Meas.	256	**90**	19	35.2	7.4	21.1	0.279
33. J. Math. Psychol.	219	**90**	17	41.1	7.8	18.9	1.224
34. *J. Res. Music. Educ.*	411	**88**	—	21.4	—	—	—
35. *Amer. J. Ment. Defic.*	560	**86**	—	15.4	—	—	0.431
36. *Animal Behavior	395	**84**	41	21.3	10.4	48.8	1.518
37. **Science*	5699	**72**	—	1.3	—	—	2.894
38. Pers. Psychophysiol.	189	**68**	18	36.0	9.5	26.5	—
39. *J. Appl. Psychology	149	**63**	28	42.3	18.8	44.4	0.804
40. *Amer. J. Psychology	196	**62**	17	31.6	8.7	27.4	0.464
41. *Psychopharmacologia*	435	**62**	—	14.3	—	—	2.409
42. Canad. Psychologist	151	**58**	24	38.4	15.9	41.4	0.170
43. *Canad. J. Psychology	100	**55**	4	55.0	4.0	7.3	1.291
44. Jap. Psychol. Res.	98	**55**	—	56.1	—	—	—
45. *J. Exp. Soc. Psych.	127	**52**	6	40.9	4.7	11.5	1.904
46. *Psychometrika	102	**51**	37	50.0	36.3	72.6	0.983
47. *Brit. J. Psychology	159	**50**	8	31.5	5.0	16.0	0.776
48. *Int. J. Cl. Exp. Hyp.*	236	**49**	—	20.8	—	—	—
49. *J. Exp. Educ.*	283	**46**	—	16.3	—	—	0.258
50. *J. Psychology	188	**45**	5	23.9	2.7	11.1	0.468

Figure 9.43 Major sources of references to psychology journals. Those marked by asterisks also are frequently cited by psychology journals. A = references to all journals. B = references to psychology journals. C = references to self. D = ratio of psychology references to all references. E = ratio of self- citations to all references (self-citing rate). F = ratio of self-citations to psychology references. G = overall impact.

Journal	A	B	C	D	E	F	G
1. *J. Exp. Psychology	1443	**1252**	400	86.8	27.7	32.0	1.867
2. *J. Comp. Phys. Psych.	1143	**999**	298	87.4	26.1	29.8	1.938
3. *J. Pers. Soc. Psych.	1177	**988**	163	83.9	13.9	16.5	1.698
4. *Psychonomic Science	567	**482**	154	85.0	27.2	32.0	0.616
5. *J. Exp. Anal. Behav.	504	**449**	255	89.1	44.6	50.1	2.395
6. *Psychol. Review	586	**447**	15	76.3	2.6	3.4	4.433
7. *Psychol. Bull.	604	**434**	21	71.9	3.5	4.8	3.081
8. **Science*	9739	**423**	—	4.3	—	—	2.894
9. *J. Cons. Clin. Psych.	472	**358**	61	75.9	12.9	17.0	1.217
10. *Psychol. Reports	420	**334**	81	79.5	19.3	24.3	0.409
11. *J. Verb. Learn. Beh.	344	**310**	45	90.1	13.1	14.5	1.374
12. *Amer. J. Psychology	339	**238**	17	70.2	5.0	7.1	0.464
13. *Perc. Motor Skills	312	**223**	108	71.5	34.6	48.4	0.438
14. *Amer. Psychologist	254	**171**	38	67.3	15.0	22.2	0.331
15. J. Clin. Psychol.	217	**161**	40	74.2	18.4	24.8	0.367
16. *J. Personality	203	**147**	32	72.4	15.8	21.8	0.761
17. *Anim. Behavior	276	**127**	41	46.0	14.9	32.3	1.518
18. *J. Appl. Psychol.	175	**120**	28	68.6	16.0	23.3	0.804
19. *Canad. J. Psychol.	161	**114**	4	70.8	2.5	3.5	1.291
20. *J. Psychology	191	**111**	5	58.1	2.6	4.5	0.468
21. *J. Couns. Psychol.	143	**110**	57	76.9	39.9	51.8	—
22. *Behav. Res. Ther.	132	**108**	68	81.8	51.5	63.0	1.504
23. *Psychol. Monogr.*	183	**108**	—	59.0	—	—	—
24. *Perc. Psychophys.	131	**104**	41	79.4	31.3	39.4	0.991
25. *Brit. J. Psychol.	178	**101**	8	56.7	4.5	7.9	0.776
26. *Psychometrika	174	**98**	37	56.3	21.3	37.8	0.983
27. Q. J. Exp. Psychol.	123	**91**	—	74.0	—	—	0.389
28. *Educ. Psych. Meas.	142	**87**	19	61.3	13.4	21.8	0.279
29. *J. Abnormal Psych.	151	**82**	28	54.3	18.5	34.2	1.586
30. *Psychophysiology	124	**82**	63	66.1	50.8	76.8	0.723
31. *Physiol. Behav.	138	**80**	48	58.0	34.8	60.0	1.496
32. Child Development	156	**76**	—	48.7	—	—	0.507
33. *EEG Clin. Neurophys.*	719	**76**	—	10.6	—	—	0.388
34. *J. Social Psychol.	119	**76**	25	63.9	21.0	32.9	0.433
35. *Amer. J. Physiology*	5417	**72**	—	1.3	—	—	3.379
36. *Nature*	15310	**72**	—	.5	—	—	2.244
37. *Arch. Gen. Psychiat.*	784	**68**	—	8.7	—	—	1.409
38. *J. Educ. Psychology	163	**68**	39	41.7	23.9	57.4	1.044
39. *Behaviour	135	**62**	39	45.9	28.9	62.9	1.294
40. *J. Acoust. Soc. Amer.*	1203	**61**	—	5.1	—	—	0.563
41. *Aerospace Medicine*	257	**58**	—	22.6	—	—	0.551
42. *J. Genetic Psychol.	159	**58**	15	36.5	9.4	25.9	0.148
43. *J. Exp. Soc. Psychol.	66	**57**	6	86.4	7.6	8.8	1.904
44. *J. General Psychol.	119	**56**	5	47.1	4.2	8.9	0.259
45. **J. Nerv. Ment. Dis.*	348	**54**	—	15.5	—	—	0.707
46. *J. Neurophysiology*	1015	**48**	—	4.7	—	—	4.582
47. *Amer. J. Psychiatry*	561	**45**	—	8.0	—	—	0.673
48. *Amer. Sociol. Review*	123	**45**	—	36.6	—	—	—
49. *Endocrinology*	2546	**45**	—	1.8	—	—	2.986
50. Human Relations	76	**43**	7	56.6	9.2	16.3	0.347

Figure 9.44 Journals cited most frequently by psychology journals. Those marked by asterisks also are major sources of references to psychology journals. A = citations from all journals. B = citations from psychology journals. C = self-citations. D = ratio of citations from psychology journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from psychology journals. G = overall impact.

	Journal	PI
1.	Psychol. Review	**351.8**
2.	Psychol. Bull.	**227.3**
3.	J. Exp. Anal. Behav.	**219.2**
4.	J. Exp. Psychology	**174.4**
5.	J. Exp. Soc. Psychol.	**158.7**
6.	J. Pers. Soc. Psych.	**151.8**
7.	J. Comp. Phys. Psych.	**148.5**
8.	J. Verb. Learn. Beh.	**118.4**
9.	Behav. Res. Ther.	**118.4**
10.	Canad. J. Psychol.	**116.7**
11.	J. Abnormal Psych.	**91.3**
12.	J. Cons. Clin. Psych.	**83.0**
13.	Physiol. Behav.	**81.9**
14.	Perc. Psychophys.	**69.8**
15.	J. Educ. Psychology	**68.7**
16.	Anim. Behavior	**67.5**
17.	J. Personality	**66.6**
18.	J. Couns. Psychol.	**64.1**
19.	J. Appl. Psychol.	**59.8**
20.	Psychometrika	**59.0**
21.	Behaviour	**52.9**
22.	Brit. J. Psychol.	**50.5**
23.	Psychonomic Science	**50.0**
24.	Psychophysiology	**42.9**
25.	Psychol. Reports	**34.5**
26.	Perc. Motor Skills	**32.7**
27.	J. Psychology	**32.4**
28.	Child Development	**30.4**
29.	Amer. J. Psychology	**28.7**
30.	J. Social Psychol.	**28.3**
31.	Amer. Psychologist	**27.5**
32.	J. Clin. Psychol.	**25.0**
33.	J. General Psychol.	**18.5**
34.	Educ. Psych. Meas.	**18.2**
35.	Q. J. Exp. Psychol.	**18.2**
36.	*Aerospace Medicine*	**13.8**
37.	*Nature*	**11.8**
38.	*Science*	**11.6**
39.	*J. Nerv. Ment. Dis.*	**11.5**
40.	Human Relations	**8.7**
41.	*J. Neurophysiology*	**8.0**
42.	J. Genetic Psychol.	**7.4**
43.	*EEG Clin. Neurophys.*	**5.2**
44.	*Endocrinology*	**4.2**
45.	*Amer. J. Physiology*	**3.4**
46.	*J. Acoust. Soc. Amer.*	**2.4**
47.	*Amer. J. Psychiatry*	**1.4**
48.	*Arch. Gen. Psychiat.*	**1.0**
49.	*Psychol. Monogr.*	—
50.	*Amer. Sociol. Review*	—

Figure 9.45 Journals cited most frequently by psychology journals, ranked by "psychology impact."

the literature indicates that they have not found much outside their world that is helpful, or that if they have, they are not admitting it in their references.

Agriculture (26)

One of the things that makes life complicated for librarians and information scientists attempting to define the nature and bounds of a journal collection for a given subject is the difference between the literature of the field and the literature of interest to the researchers working in the field. A study of the journal literature of agriculture demonstrated that the difference can be considerable and that citation analysis can define it.

The data base used for this study was all the journals listed in the 1969 *SCI* for subjects that are obviously agricultural in nature, such as agriculture, food technology, botany, entomology, ecology, fisheries, forestry, horticulture, parasitology, and soil science. From this group, we removed any journals that dealt primarily with genetics or microbiology because we did not want the close relationship of these subjects to other areas of basic reseach to distort the picture of agriculture as a more applied science. We did add to the core group a few journals that we thought appropriate, such as *Pesticides Biochemistry* and the *Journal of the Association of Official Chemists,* but none of the major multidisciplinary journals in which agricultural scientists like to publish. By the time we finished, the core group contained 347 journals.

Figure 9.46 shows the journals most frequently cited by the agricultural core group. Figure 9.47 shows the ones that cited the core group most frequently. The difference between them illustrates the difference between the agricultural literature and the literature that agricultural scientists use.

The list of the major sources of citations to the core group consisted, primarily, of the journals usually thought of as being agricultural—what is considered the literature of the field. In contrast, the list of journals most frequently cited by the core group was dominated by journals that very few people would think of as agricultural, yet they are the journals that agricultural scientists use—the literature of interest to the research scientists working in the field.

A more general view of the difference between the literature of agriculture and the literature of interest to agricultural scientists is shown by the statistics. The core group was shown to have cited 1650 publications, plus innumerable theses. Most of the 1650 publications consisted of journals. The number of journals that cited the core group, however, amounted to only 395.

These results make it obvious that an agricultural library or information service must cover considerably more than the agricultural journals in order to serve its constituency.

Engineering (27)

A citation study of the 240 journals listed by *SCI* in the various categories of engineering (general, chemical, civil, electrical and electronic, mechanical) produced

	Journal	A	B	C	D	E	F	G
1.	Phytopathology	1713	1460	822	85.2	48.0	56.3	1.078
2.	Nature	15310	1128	—	7.4	—	—	2.244
3.	Plant Physiol.	1639	1107	200	67.5	12.2	18.1	1.683
4.	J. Biol. Chem.	17103	791	—	4.6	—	—	6.371
5.	J. Econ. Entomol.	900	778	508	86.4	56.4	65.3	0.782
6.	Amer. J. Bot.	1171	696	73	59.4	6.2	10.5	0.956
7.	Science	9739	638	—	6.6	—	—	2.894
8.	J. Dairy Sci	902	619	382	68.6	42.4	61.9	0.507
9.	Agron. J.	727	529	163	72.8	22.4	30.8	0.947
10.	Biochem. J.	7625	528	—	6.9	—	—	3.193
11.	J. Animal Sci	734	482	247	65.7	33.7	51.0	0.405
12.	Poultry Sci.	697	456	351	65.4	50.4	77.0	0.488
13.	Soil Sci.	629	443	61	70.4	9.7	13.8	0.923
14.	Biochim. Biophys Acta	9500	438	—	4.6	—	—	3.287
15.	Soil Sci. Soc.	553	400	112	72.3	20.3	28.0	0.867
16.	Planta	707	391	123	55.3	17.4	31.5	2.944
17.	J. Parasitology	708	368	80	52.0	11.3	21.7	1.351
18.	Canad. J. Bot.	548	357	62	65.2	11.3	17.4	1.217
19.	J. Agr. Food Chem.	509	324	98	63.7	19.3	30.3	1.665
20.	J. Bacteriol.	4138	319	—	7.7	—	—	3.594
21.	J. Amer. Soc. Hort. Sci.	357	301	182	84.3	60.0	60.5	0.392
22.	Physiol. Plant.	482	283	52	58.7	10.8	18.4	1.796
23.	J. Ass. Off. An. Chem.	478	277	181	57.9	37.9	65.3	—
24.	Weed Sci.	311	275	171	88.4	55.0	62.2	1.568
25.	Phytochemistry	588	273	153	46.4	26.0	56.0	1.907
26.	J. Agr. Sci.	420	269	106	64.1	25.2	39.4	0.912
27.	Comptes Rendus D	5642	256	—	4.5	—	—	0.780
28.	Ann. Bot.	424	255	30	60.1	7.1	7.1	1.443
29.	Crop Sci.	353	255	104	72.2	29.5	40.8	0.712
30.	Analyt. Chem.	4219	251	—	6.0	—	—	1.661
31.	Ecology	577	251	118	43.5	20.5	74.9	1.256
32.	Arch. Biochem. Biophys.	3647	247	—	6.8	—	—	3.519
33.	Food Technol.	346	242	62	70.0	17.9	25.6	0.787
34.	Exp. Parasitol.	428	240	161	56.1	37.6	67.1	3.000
35.	Plant Dis. Rep.	286	236	—	82.5	—	—	0.268
36.	J. Cell Biol.	4769	234	—	4.9	—	—	3.484
37.	J. Amer. Chem. Soc.	26307	218	—	0.8	—	—	5.859
38.	Austr. J. Agr. Res.	308	212	89	68.8	28.9	42.0	1.051
39.	Ann. Entom. Soc. Am.	329	211	54	64.1	19.5	30.3	0.537
40.	Bot. Gazette	312	210	9	67.3	2.9	4.3	0.658
41.	Ann. Appl. Biol.	453	209	—	46.1	—	—	1.386
42.	J. Exp. Bot.	337	205	63	60.8	18.7	30.7	2.400
43.	J. Sci. Food Agr.	367	202	87	55.0	23.7	43.1	0.881
44.	J. Nutrition	1209	201	—	16.6	—	—	2.087
45.	J. Food Sci.	383	197	41	51.4	10.7	20.8	0.871
46.	P. Nat. Acad. Sci. USA	8206	196	—	2.4	—	—	8.828
47.	J. Protozool.	446	191	104	42.8	54.5	23.3	0.884
48.	Zbl. Bakt. Parasitenk.	407	186	166	45.7	40.8	89.3	0.703
49.	Mycologia	302	185	51	61.3	16.9	27.6	0.901
50.	Austr. J. Biol. Sci.	583	184	—	31.6	—	—	1.957
51.	Canad. Entomol.	225	182	55	80.9	24.4	30.2	0.445
52.	Cereal Chem.	286	182	71	63.6	24.8	39.0	1.210
53.	J. Insect Physiol.	487	180	139	37.0	28.5	77.2	1.932
54.	T. Brit. Mycol. Soc.	263	173	73	65.8	27.8	42.2	0.830
55.	Agr. Biol. Chem.	356	172	143	48.3	40.2	83.1	0.939
56.	New Phytologist	295	172	54	58.3	18.3	31.4	1.362
57.	Virology	2373	171	—	7.2	—	—	4.720
58.	Annu. Rev. Plant Phys.	290	170	—	58.6	—	—	7.047
59.	P. Soc. Exp. Biol. Med.	5011	168	—	3.4	—	—	1.964
60.	J. Agr. Res.	267	167	—	62.6	—	—	—
61.	J. Fish. Res. Bd. Can.	336	164	122	48.8	36.3	74.4	—
62.	Parasitology	297	161	44	54.2	14.8	27.3	0.866
63.	Amer. J. Trop. Med. Hyg.	854	153	—	17.9	—	—	2.078
64.	J. Gen. Microbiol.	1438	145	—	10.1	—	—	2.337
65.	J. Chem. Soc.	13978	142	—	1.0	—	—	3.123
66.	J. Wildl. Managem.	180	128	112	71.1	62.2	87.5	0.501
67.	J. Range Managem.	126	120	60	95.2	47.6	50.0	0.551
68.	Plant Soil	202	116	52	57.4	25.7	44.8	0.988
69.	J. Animal Ecol.	239	115	50	48.1	20.9	43.5	0.795
70.	Plant Cell Physiol.	203	114	75	56.2	37.0	65.8	1.785
71.	Ann. Trop. Med. Paras.	381	113	32	29.7	8.4	28.3	1.398
72.	T. Roy. Soc. Trop. Med.	553	110	—	19.9	—	—	—
73.	Ann. New York Acad. Sci.	3756	107	—	2.9	—	—	1.815
74.	Appl. Microbiol.	583	107	—	18.4	—	—	1.278
75.	Canad. J. Plant Sci.	138	106	32	76.8	23.2	30.2	0.615

Figure 9.46 Journals cited most frequently by agricultural journals. A = citations from all journals. B = citations from agricultural journals. C = self-citations. D = ratio of citations from agricultural journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from agricultural journals. G = overall impact.

	Journal	A	B	C	D	E	F	G
1.	Phytopathology	2830	1039	822	36.7	31.2	79.1	1.078
2.	J. Econ. Entomol.	1446	660	508	45.6	35.1	77.0	0.782
3.	J. Dairy Sci.	1350	466	382	34.5	28.3	82.0	0.507
4.	Annu. Rev. Phytopath.	2181	453	—	20.8	—	—	4.914
5.	Poultry Sci.	1291	414	351	32.0	27.2	84.8	0.488
6.	Agron. J.	1008	355	163	35.2	16.2	45.9	0.947
7.	J. Animal Sci.	964	349	247	36.2	25.6	70.8	0.405
8.	Plant Physiol.	960	300	200	31.3	20.8	66.7	1.683
9.	Exp. Parasitol.	2219	260	161	11.7	7.3	61.9	3.000
10.	Weed Sci.	564	251	171	44.5	30.3	68.1	1.568
11.	J. Ass. Off. An. Ch.	878	242	181	27.6	20.6	74.8	—
12.	J. Agr. Food Chem.	903	238	98	26.4	10.9	41.2	1.665
13.	J. Am. S. Hort. Sci.	755	235	182	31.1	24.1	77.4	0.392
14.	Planta	1085	213	123	19.6	11.3	57.8	2.944
15.	Phytochemistry	1473	207	153	14.1	10.4	74.0	1.907
16.	Botan. Rev.	772	205	6	26.6	0.8	2.9	3.818
17.	J. Agr. Sci.	653	194	106	29.7	16.2	54.6	0.912
18.	Canad. J. Bot.	768	194	62	25.3	8.1	31.9	1.217
19.	Ecology	991	194	118	19.6	11.9	60.8	1.256
20.	Plant Soil	820	193	52	23.5	6.3	26.9	0.988
21.	Agr. Biol. Chem.	1108	184	143	16.6	12.9	77.7	0.939
22.	Mycop. Mycol. Appl.	2831	177	80	6.3	2.8	45.2	0.346
23.	Soil Sci. Soc.	608	175	112	28.8	18.4	64.0	0.867
24.	J. Insect Physiol.	1129	174	139	15.4	12.3	80.0	1.932
25.	T. Brit. Mycol. S.	549	171	73	31.2	13.3	42.7	0.830
26.	J. Fish. Res. Bd.	1174	166	122	14.4	10.4	73.5	—
27.	Austr. J. Agr. Res.	669	163	89	24.4	13.3	54.6	1.051
28.	Amer. J. Bot.	590	162	73	27.5	12.4	45.1	0.956
29.	Plant Cell Physiol.	820	162	75	19.8	9.2	46.3	1.785
30.	Soil Sci.	405	146	61	36.1	15.1	41.8	0.923
31.	J. Sci. Food Agr.	738	146	87	19.8	11.8	59.6	0.881
32.	Protoplasma	965	143	—	14.8	—	—	2.183
33.	Ind. J. Agr. Sci.	959	135	52	14.1	5.4	38.5	0.334
34.	Weed Res.	467	132	28	28.3	6.0	21.2	—
35.	New Phytologist	579	123	54	21.2	9.3	43.9	1.382
36.	Mycologia	444	120	51	27.0	11.5	42.5	0.901
37.	Physiol. Plant.	486	108	52	22.2	10.6	48.1	1.796
38.	Comptes Rendus D	3784	108	—	2.9	—	—	0.780
39.	Canad. J. Zool.	1663	106	—	6.4	—	—	0.978
40.	J. Austr. I. Agr.	580	102	19	17.6	3.3	18.6	—
41.	J. Brit. Grassl.	346	101	61	29.2	17.6	60.4	0.612
42.	Cereal Chem.	301	99	71	32.9	23.6	71.7	1.210
43.	Ann. Ent. Soc. Am.	673	95	64	14.1	9.5	67.4	0.537
44.	J. Soil Sci.	302	94	27	31.1	8.9	28.7	0.861
45.	J. Chromatogr.	2506	91	—	3.6	—	—	1.378
46.	Z. Pflanzenphys.	414	86	24	20.8	5.8	27.9	1.048
47.	J. Range Managem.	298	81	60	27.2	20.1	74.1	0.551
48.	Ann. NY Acad. Sci.	10461	73	—	0.7	—	—	1.815
49.	Mosquito News	214	72	65	33.7	30.4	90.3	0.428
50.	Bioch. Bioph. Acta	10269	71	—	0.7	—	—	3.287
51.	J. Repr. Fertil.	1203	69	—	5.7	—	—	2.014
52.	Arch. Mikrobiol.	1318	69	—	5.2	—	—	2.120
53.	Zschr. Parasitenk.	434	68	40	15.7	9.2	58.8	2.208
54.	B. Torrey Bot. Club	366	67	13	18.3	3.6	19.4	0.623
55.	Ber. Deut. Bot. Ges.	669	67	20	10.0	3.0	29.9	0.519
56.	J. Animal Ecol.	389	66	50	17.0	12.9	75.8	0.795
57.	Austr. J. Biol. Sci.	1245	66	—	5.3	—	—	1.957
58.	Phyton	364	65	12	17.9	3.3	18.5	—
59.	Amer. Potato J.	182	64	29	35.2	28.6	81.3	0.342
60.	Forest Chron.	485	63	29	13.0	6.0	46.0	—
61.	Theor. Appl. Genet.	776	62	—	8.0	—	—	—
62.	Parasitology	441	61	44	13.8	10.0	72.1	0.866
63.	Oikos	739	60	—	8.1	—	—	1.019
64.	Science	5699	59	—	1.0	—	—	2.894
65.	Bull. Entomol. Res.	238	58	45	24.4	18.9	77.6	0.674
66.	J. Stored Prod. Res.	452	57	18	12.6	4.0	31.6	—
67.	Comp. Biochem.	1945	57	—	2.9	—	—	1.477
68.	Zucker	162	56	56	34.6	34.6	99.9	—
69.	P. NAS India A	658	56	—	8.5	—	—	—
70.	J. Sci. Ind. R. B	976	55	—	5.6	—	—	—
71.	Nature	6777	55	—	0.8	—	—	2.244
72.	T. Amer. Fish. Soc.	386	54	32	14.0	8.3	59.3	0.333
73.	Z. Pflanzenzucht.	418	54	21	12.9	5.0	38.9	—
74.	Appl. Microbiol.	1453	54	—	3.7	—	—	1.278
75.	Phytomorphology	223	52	13	23.3	5.8	25.0	—

Figure 9.47 Major sources of references to agricultural journals. A = references to all journals. B = references to agricultural journals. C = references to self. D = ratio of agricultural references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to agricultural references. G = overall impact.

the view of the journal literature of engineering that is shown in Figure 9.48 and 9.49. It is important to realize that the role played by the journal literature is not the same in engineering as it is in most of the disciplines of science. The work most heavily cited in the engineering journals tends to be books rather than journal articles. In an unpublished ISI study, we found that books accounted for two-thirds of the items cited nine or more times by engineering journals in 1973. This means that an analysis of the journal literature of engineering leaves undefined a major part of the formal communication system of that particular group of disciplines. Nevertheless, the results of such an analysis still produce some interesting insights.

For example, Figure 9.48 shows that the journal most frequently cited by the core group of engineering journals was the *Proceedings of the Institute of Electrical and Electronic Engineers*. Two aspects of its performance were particularly noteworthy. One was that self-citations contributed very little to its top ranking. Its self-cited rate as a percent of citations originating in references from engineering journals was only 20%, which is unusually low for a high-ranking journal. In contrast, the comparable self-citation rate for *Thermal Engineering USSR* (*Toploenergetika*), which ranked seventeenth, was 93%. The second noteworthy characteristic was that engineering journals accounted for only a little more than 50% of *Proc. IEEE*'s citation rate. The other half of the citations received originated in basic physics journals. This finding says that *Proc. IEEE* was as much a basic physics journal as an engineering journal.

Figure 9.48 also demonstrated the dependence of engineering on basic research. The ubiquitous *Science* and *Nature* were among the 50 journals most frequently cited by the core group, as were *Physical Review*, *Proceedings of the Royal Society* (*London*), *Journal of the American Chemical Society*, *Journal of Chemical Physics*, and *Journal of Physical Chemistry*. Figure 9.49 shows that the dependence was not mutual. The list of journals that were the major sources of references that cited the core group would have had to be extended to include the top several hundred before *Nature* and *Science* would have been picked up. Only 37 of *Nature*'s references cited the core group, and *Science* did it only 33 times.

The most surprising finding in Figure 9.49 is that *Doklady Akademii Nauk USSR* was the top source of citations to the core group. This reflected the heavy technological orientation of the leading journal of the Soviet Academy of Science, and of Soviet research in general. No fewer than nine Russian journals appeared among the top 50 sources of citations to the core group, whereas only three appeared among the top 50 journals cited by the group.

One more important point made by this study of the journal literature of engineering is worth mentioning, not because it is surprising in any way, but because it provides additional confirming evidence of an important general characteristic of the journal literature. Despite the diversity of engineering subjects, the journal literature that supports all of them exhibited the same bibliographic law of concentration that is seen in the literature of the more tightly focused disciplines and specialties of basic research. The 50 journals in Figure 9.48 accounted for 52% of all the references published by the core group. The 50 journals in Figure 9.49 accounted for 56% of all the citations received by it. And, with just three or four exceptions,

	JOURNAL	A	B	C	D	E	F	G
1.	* Proc. IEEE	1601	870	175	54.3	10.9	20.1	1.372
2.	Indust. & Eng. Chem.	1582	659	101	41.7	6.4	15.3	1.123
3.	Trans. ASME	409	631	0				0.320
4.	* J. Geophys. Res.	3556	520	–	14.6			3.665
5.	* J. Appl. Phys.	5274	493	–	9.4			1.936
6.	* Radiotekhnika i Elektronika	575	475	380	82.6	66.1	80.0	0.756
7.	* IEEE Tr. Power App. & Syst.	460	451	434	98.0	94.4	96.2	0.631
8.	IEEE Tr.	763	396	–	51.9			–
9.	* Bell Syst. Tech. J.	690	395	149	57.3	21.6	37.7	1.990
10.	J. Am. Chem. Soc.	26307	384	–	1.5			5.859
11.	* Tr. Met. Soc. AIME	1348	384	292	28.5	21.7	76.0	4.942
12.	* J. Fluid Mech.	962	370	243	38.5	25.3	65.7	2.376
13.	* AICHE J.	554	362	71	65.4	12.8	19.6	1.559
14.	Phys. Rev.	20666	334	–	1.6			3.679
15.	* Proc. IEE	489	312	130	63.8	26.6	41.7	0.809
16.	* AIAA J.	1247	301	–	24.1			1.228
17.	* Therm. Eng. USSR	336	295	275	87.8	81.9	93.2	0.572
18.	* Chem. Eng. Sci.	425	290	66	68.2	15.5	22.8	1.514
19.	* IEEE Tr. Ant. Propag.	335	287	135	85.7	40.3	47.0	1.568
20.	J. Chem. Phys.	13687	255	–	1.9			3.180
21.	* Radio Science	363	243	194	66.9	53.4	79.8	2.508
22.	Appl. Phys. Lett.	1318	215	–	16.3			3.688
23.	J. Electrochem. Soc.	1371	204	–	14.9			0.797
24.	* IEEE Tr. Microwave Theory & Techn.	273	203	138	74.4	50.6	68.0	1.242
25.	* IEEE Tr. Inform. Theory	263	199	95	75.7	36.1	47.7	0.946
26.	Proc. Roy. Soc. London	4789	192	–	4.0			2.998
27.	J. Phys. Chem.	4678	183	–	3.9			2.429
28.	Nature	15310	181	–	1.2			2.244
29.	J. Chem. Soc.	13978	180	–	1.3			3.123
30.	* IEEE Tr. Autom. Contr.	222	175	112	78.8	50.5	64.0	0.684
31.	* IEEE Tr. Electr. Dev.	298	172	94	57.7	31.5	54.7	0.792
32.	* Nucl. Sci. Eng.	485	172	165	35.5	34.0	95.9	1.290
33.	J. Cryst. Growth	232	171	–	73.7			2.277
34.	* IEEE Tr. Circ. Th.	265	166	91	62.6	34.3	54.8	1.344
35.	Textile Res. J.	446	158	149	35.4	33.4	94.3	0.882
36.	* J. Acoust. Soc. Amer.	1203	152	–	12.6			0.563
37.	J. Atmos. Terr. Phys.	482	152	–	31.5			1.642
38.	Chem. Eng. Progr.	229	145	3	63.3	1.3	2.1	0.162
39.	Solid-State Electr.	348	139	33	39.9	9.5	23.7	1.993
40	Planet. Sp. Sci.	496	138	83	27.8	16.7	60.1	2.753
41.	J. Phys. Chem. Solids	1419	137	–	9.7			2.073
42.	* J. Catalysis	428	131	111	30.6	25.9	84.7	2.448
43.	Phys. Fluids	1294	126	–	9.7			1.581
44.	* Electronics Lett.	311	125	–	40.2			0.810
45.	* J. Spacecraft & Rockets	166	117	113	70.5	68.1	96.6	0.448
46.	Chem. Eng.	251	112	41	44.6	16.3	36.6	–
47.	Phys. Rev. Lett.	6544	110	–	1.7			5.114
48.	Tr. Faraday Soc.	2911	109	–	3.7			2.149
49.	Science	9739	105	–	1.1			2.894
50.	Vest. Mashinostr.	134	105	–	78.4			0.557

Figure 9.48 Journals cited most frequently by engineering journals. Those marked by asterisks also are major sources of references to engineering journals. A = citations from all journals. B = citations from engineering journals. C = self-citations. D = ratio of citations from engineering journals to citations from all journals. E = all ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from engineering journals. G = overall impact.

	JOURNAL	A	B	C	D	E	F	G
1.	DAN SSSR	7647	958	837	12.5	11.0	87.4	0.572
2.	* Radio Science	2083	689	194	33.1	9.3	28.2	2.508
3.	* AIAA J.	2616	652	502	24.9	19.2	77.0	1.228
4.	* IEEE Tr. Power App. & Syst.	1122	622	434	55.4	38.7	69.8	0.631
5.	Instr. Exp. Techn.	1513	583	469	38.5	31.0	80.5	0.357
6.	Ind. Eng. Chem.	2952	562	101	19.0	3.4	18.0	1.123
7.	* Radiotekhnika i Elektronika	1451	538	380	37.1	26.2	70.6	0.756
8.	* J. Acoust. Soc. Amer.	1440	524	443	36.4	30.8	84.5	0.563
9.	* J. Appl. Phys.	5811	503	–	8.7			1.936
10.	* Proc. IEEE	1702	465	175	27.3	10.3	37.6	1.372
11.	Vysokomol. Soed. A	1750	411	289	23.5	16.5	70.2	0.559
12.	* Electronics Lett.	744	379	108	50.9	14.5	28.5	0.810
13.	* Proc. IEE	891	376	130	42.2	14.6	34.6	0.809
14.	Telecomm. Radioeng. USSR	738	326	48	44.2	6.5	14.7	–
15.	* J. Fluid Mech.	1271	347	243	27.3	19.1	70.0	2.376
16.	J. Appl. Mech	1090	319	103	29.2	9.5	32.3	–
17.	* J. Spacecraft & Rockets	1638	313	113	19.1	6.9	36.1	0.448
18.	* Tr. Met Soc. AIME	1706	312	292	18.3	17.1	93.6	4.942
19.	* IEEE Tr. Electr. Dev.	773	311	94	40.2	12.2	30.2	0.792
20.	* IEEE Tr. Microwave Theory & Techn.	697	306	138	43.9	19.8	45.1	1.242
21.	* Therm. Eng. USSR	770	302	275	39.2	35.7	91.1	0.572
22.	IEEE Tr. Magnetics	1244	299	162	24.0	13.0	54.2	1.340
23.	* IEEE Tr. Ant. Propag.	622	274	135	44.1	21.7	49.3	1.568
24.	Internat. J. Electronics	784	260	43	33.2	5.5	16.5	–
25.	Electr. Comm. Japan	804	247	39	30.7	4.9	15.8	–
26.	* IEEE Tr. Autom. Contr.	649	245	112	37.8	17.3	45.7	0.684
27.	J. Basic Eng.	1010	243	24	24.1	2.4	9.9	–
28.	Chim. Ind. (Milan)	1068	233	44	21.8	4.1	18.9	0.240
29.	Annu. Rev. Fl. Mech.	943	229	–	24.3			
30.	* Bell Syst. Techn. J.	505	215	149	42.6	29.5	69.3	1.990
31.	Tr. Amer. Nucl. Soc.	2019	211	–	10.5			0.388
32.	* Chem. Eng. Sci.	425	200	66	47.1	15.5	33.0	1.514
33.	Meas. Techn. USSR	525	199	186	37.9	35.4	93.5	–
34.	Ind. Eng. Chem. F.	816	187	67	22.9	8.2	35.8	–
35.	* IEEE Tr. Inform. Theory	483	181	95	37.5	19.7	52.5	0.946
36.	IEEE Tr. Computers	489	172	94	35.2	19.2	54.7	0.821
37.	* Nucl. Sci. Eng.	813	168	165	20.7	20.3	98.2	1.290
38.	Phys. Stat. Sol.	4973	166	–	3.3			1.578
39.	Ind. Eng. Chem. Proc. D&D	350	162	–	46.3			–
40.	* J. Geophys. Res.	3671	161	–	4.4			3.665
41.	Tr. Inst. Chem. Eng.	787	158	30	20.1	3.8	19.0	0.583
42.	* IEEE Tr. Circ. Th.	381	153	91	40.2	23.9	59.5	1.344
43.	Autom. Rem. Contr. USSR	437	152	138	34.8	31.6	90.8	0.340
44.	* J. Catalysis	610	148	111	24.3	18.2	75.0	2.448
45.	* AICHE J.	351	137	71	39.0	20.2	51.8	1.559
46.	Eur. Polym. J.	1308	131	–	10.0			–
47.	Nachrichttech. Z.	512	128	–	25.0			–
48.	Russ. J. Phys. Chem. USSR	2527	127	–	5.0			0.838
49.	IEEE Tr. Nucl. Sci.	652	121	64	18.6	9.8	52.9	0.722
50.	Nucl. Instr. Meth.	1656	119	–	7.2			1.016

Figure 9.49 Major sources of references to engineering journals. Those marked by asterisks also are among those journals cited most frequently by engineering journals. A = references to all journals. B = references to engineering journals. C = references to self. D = ratio of engineering references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to engineering references. G = overall impact.

the journals on both lists that have titles that indicate a high degree of specialization were all found among the 500 journals most frequently cited by the full range of scientific and technical journals. In fact, almost half of the journals on the two lists were among the 152 most cited journals of 1969.

Russian Journal Literature (28)

An analysis of the literature of Russian science was the first of a series of studies aimed at testing the ability of citation analysis to characterize national literatures in some useful ways. The tools of the analysis were the same ones used for the previous studies: a selected group of core journals, a list of the journals most cited by the core group, and a second list of the journals that were the major sources of references that cited the core group. In this particular study, two sets of such lists were produced, one set based on the citation data of 1972 (Figures 9.50 and 9.51) and the other based on the data of 1974 (Figures 9.52 and 9.53). The reason for the two sets was to see if any changes in characteristics could be identified.

The core group on which the study was based consisted of all Russian journals covered as reference sources by *SCI* during 1972 and 1974. Categorized as Russian are the journals published within the Soviet Union, the translation journals published outside of the Soviet Union to make Soviet science more accessible, and a few Slavic journals. In 1972, 83 source journals (accounting for 3.4% of *SCI*'s journal coverage and 7% of its source-item coverage) fit into that category. By 1974, the number had increased to 102 (accounting for 4.2% of *SCI*'s journal coverage and about 6.5% of its source-item coverage). If the core groups appear to be too small to be representative of the Russian literature, it should be noted that all the journals on the two lists of those most cited by the Russian literature (Figures 9.51 and 9.53) are part of *SCI*'s source coverage. In other words, none of the Russian journals not covered by *SCI* were cited frequently enough to rank among the 75 journals cited most frequently by the Russian scientists publishing in the core groups. This indicates that though the core groups used certainly do not cover the entire Russian literature, they do cover the journals that probably are used most by Russian scientists.

There are, however, two important qualifications that must be made about the study. One is that it does not necessarily reflect the total bibliographic impact of all Soviet science and technology. Because the analysis was limited to core groups of Russian journals, the many highly cited articles published by Soviet scientists in "outside" journals were not reflected in the statistics. The other point of qualification is that the citation practices of the translation journals tend to inflate the citation rates of Russian journals through duplicate references. Rather than go into a detailed explanation about how these practices distort the citation picture (28), I will simply say that all possible care was taken to eliminate the effect and to make the counts as accurate as possible.

The main purpose of this study was to measure the amount of cross citation between the Russian literature and other ones, and to determine whether there was any significant change between 1972 and 1974. One such measure was provided by

Journals	A	B	C	D	E	F	G
1. Dokl Akad Nauk SSSR Proc Acad Sci USSR	20548	4344	1218	21.14	5.9	28.04	0.372
2. Zh Fiz Khim Russ J Phys Chem	7005	2714	1302	38.7	18.6	48.0	0.534
3. Zh Neorg Khim J Inorg Chem	7398	2699	1591	36.5	21.5	59.0	0.482
4. Zh Obshchei Khim J General Chem USSR	6900	2585	975	37.5	14.1	37.7	0.538
5. Fiz Tekh Poluprr Vodn Sov Phys Semiconduct	6731	2572	1402	38.2	20.8	54.5	1.530
6. IAN SSSR Ser Khim B Acad Sci USSR Chem Sci	6525	2536	1250	38.9	19.2	49.3	0.799
7. Vysokomolek Soed High Mol Cpds	7682	2255	1089	29.4	14.2	48.3	0.544
8. Zh Org Khim J Org Chem USSR	6580	2183	465	33.2	7.1	21.3	0.807
9. Zh Eksp Teor Fiz Sov Phys JETP	4898	2128	1284	43.5	26.2	60.3	2.808
10. Fiz Tverdogo Tela Sov Phys Solid State	8187	2120	680	25.9	8.3	32.1	1.591
11. Zh Prikl Khim J Appl Chem USSR	6193	1841	494	29.7	8.0	26.8	0.151
12. Optika Spektroskopiya Opt Spectrosc USSR	3201	1766	822	55.2	25.7	46.6	0.649
13. Zh Analit Khim J Analyt Chem USSR	6976	1660	813	23.8	11.7	49.0	1.008
14. Yadernaya Fiz Sov J Nucl Phys	4449	1647	919	37.0	20.7	55.8	0.662
15. Usp Khim Adv Chem	12611	1636	144	13.0	1.1	8.8	1.747
16. Phys Rev B Solid State	28202	1559	—	5.5	—	—	2.814
17. Zh Eksp Teor Fiz P JETP Letters	3245	1554	578	47.9	17.8	37.2	1.299
18. Zh Tekh Fiz Sov Phys Tech Phys	3514	1405	691	40.0	19.7	49.2	1.170
19. IAN SSSR Ser Fiz B #1 Acad Sci USSR Phys Sci	4043	1347	517	33.3	12.8	38.4	0.499
20. Analytical Chemistry	28806	1346	—	4.6	—	—	5.187
21. Fiz Met Metaloved Phys Met Metallogr USSR	3949	1188	508	30.1	12.9	42.8	1.003
22. IVUZ Fizika B Inst Higher Educ Phys	4815	1155	390	24.0	8.1	33.8	0.270
23. Khim Geterotsikl Soed Chem Het Cpds USSR	3642	1089	447	29.9	12.3	41.1	0.542
24. Uspekhi Fiz Nauk Soviet Physics, Uspekhi	6273	1063	70	17.0	1.1	6.6	4.970
25. Teplofiz Vysok Temp High Temp USSR	2655	1026	570	38.6	21.5	55.6	0.773
26. Radiotekh Elektronika Radio Eng Electr Phys USSR	3124	976	585	31.2	18.7	60.0	0.299
27. Kristallografiya Sov Phys Crystallography	2453	953	449	38.9	18.3	47.1	1.061
28. Ukrainskii Khim Zh Ukrainian Chem J	3191	953	310	29.9	9.7	32.5	0.287

Figure 9.50 Major sources of references to Russian journals in 1972. A = references to all journals. B = references to Russian journals. C = references to self. D = ratio of Russian references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to Russian references. G = overall impact.

29.	Tsitologiya Cytology	4237	946	473	22.3	11.2	50.0	0.383
30.	Zh Mikrob Epidem Immun J Microb Epidem Immun USSR	5524	946	649	17.1	11.8	68.6	0.247
31.	Zh Strukt Khim J Struct Chem USSR	2670	834	414	31.2	15.5	49.6	0.790
32.	Izmertel Tekh Meas Tech USSR	2236	831	737	37.2	33.0	88.7	0.109
33.	J Chem Phys	42071	829	—	2.0	—	—	3.341
34.	Biull Eksp Biol Med B Exp Biol USSR	5227	824	313	15.8	6.0	38.0	0.294
35.	Antibiotiki Antibiotics	3047	820	550	26.9	18.1	67.1	—
36.	Phys Rev A Gen Phys	16036	792	—	4.9	—	—	2.86
37.	Zh Vys Nev Deyatel Pavlov Pavlov J Higher Nerv Act	2287	785	480	34.3	21.0	61.2	—
38.	Kolloidnyi Zh Colloid Journal USSR	2009	779	347	38.8	17.3	44.5	0.550
39.	Phys St Sol B	8947	759	—	8.5	—	—	0.962
40.	Avtomat Telemekh Automat Rem, Contr USSR	2273	755	589	33.2	25.9	78.0	0.004
41.	Phys St Sol A	8373	743	—	8.9	—	—	1.253
42.	Physical Review Letters	15677	705	—	4.5	—	—	4.962
43.	Genetika Genetics USSR	3798	687	458	18.1	12.1	66.7	0.509
44.	Svar Proiz Welding Production USSR	1376	662	515	48.1	37.4	77.8	0.069
45.	Biofizika Biophysics USSR	2651	658	306	24.8	11.5	46.5	0.852
46.	Geokhimiya Geochemistry International USSR	2503	652	373	26.1	14.9	57.2	0.049
47.	Biokhimiya Biochemistry USSR	2829	632	308	22.3	10.9	48.7	0.874
48.	Teploenergetika Therm Eng USSR	1564	630	535	40.3	34.2	84.9	0.507
49.	J Organomet Chem	14458	608	—	4.2	—	—	2.717
50.	Mikrobiologiya Microbiology USSR	2132	571	293	26.8	13.7	51.3	—
51.	IAN Fiz Atmos Okeana BAS USSR, Atmos Oceanic Phys	1763	546	314	31.0	17.8	57.5	0.456
52.	Japan Analyst	8828	542	—	6.1	—	—	0.093
53.	Prib Tekh Eksp Instr Exp Techn USSR	2554	537	167	21.0	6.5	31.1	0.311
54.	Zavod Lab Industr Lab USSR	3001	524	—	17.5	—	—	0.388
55.	Ukr Biokhim Zh Ukrainian Biochem J	2409	512	249	21.3	10.3	48.6	—
56.	J Appl Physics	14923	480	—	3.2	—	—	1.645
57.	Nuclear Physics A	23538	480	—	2.0	—	—	2.453
58.	Vestn Mosk Univ Khim	—	475	135	—	—	28.4	0.047
59.	Astronom Zh Sov Astronomy J	2370	472	336	19.9	14.2	71.2	1.079
60.	Phys Rev D Part Field	17379	458	—	2.6	—	—	2.906
61.	Atomnaya Energiya Sov Atomic Energy	1732	454	212	26.2	12.2	46.7	0.603
62.	Nuclear Fusion	1760	452	—	25.7	—	—	1.515

Figure 9.50 (continued)

63.	Molekulyarnaya Biol Molecular Biology USSR	2303	440	172	19.1	7.5	39.1	1.070
64.	Khim Prirod Soed Chem Natural Prod USSR	2003	433	274	21.6	13.7	63.3	0.460
65.	Physics Letters A	7733	427	—	5.5	—	—	1.034
66.	Sov Med Soviet Medicine	5656	422	149	7.5	2.6	35.31	0.043
67.	J Electroanalyt Chem	—	400	—	—	—	—	1.349
68.	Radiotekhnika Telecomm Radio Eng USSR 2	2190	400	297	18.3	13.6	74.3	0.129
69.	Bull Soc Chim Fr	17009	395	—	2.3	—	—	1.139
70.	IAN SSSR Ser Biol BAS USSR, Biology	3163	391	—	12.4	—	—	—
71.	Vopr Virusologii Probl Virology	2522	391	256	15.5	10.2	65.5	0.438
72.	Okeanologiya Oceanology USSR	1671	385	195	23.0	11.7	50.7	—
73.	Fiz Goreniya i Vzryva Comb Expl Shock Waves	1207	382	99	31.7	18.2	25.9	—
74.	Phys Rev C Nucl Phys	11481	367	—	3.2	—	—	2.657
75.	Avtomat Svarka Automatic Welding, USSR	976	363	343	37.2	35.1	94.5	0.285

Figure 9.50 (continued)

Journals		A	B	C	D	E	F	G
1.	Dokl Akad Nauk SSSR Proc Acad Sci USSR	12260	6420	1218	52.4	9.9	19.0	0.372
2.	J Amer Chem Soc	104344	5427	—	5.2	—	—	4.745
3.	Zh Eksp Teor Fiz Sov Phys JETP	13791	5419	1284	39.3	9.3	23.7	2.808
4.	J Chem Phys	9744	3435	—	35.25	—	—	1.591
5.	Zh Fiz Khim Russ J Phys Chem	7039	3421	1302	48.6	18.5	38.1	0.534
6.	Zh Eksp Teor Fiz P JETP Letters	4896	3303	578	67.5	11.8	17.5	1.299
7.	Zh Org Khim J Org Chem USSR	3614	3137	1434	86.8	39.7	45.7	0.807
8.	Fiz Tverdogo Tela Sov Phys Solid State	9744	3028	1426	31.08	14.6	47.1	1.591
9.	J Appl Phys	21168	2502	—	11.8	—	—	1.645
10.	IAN SSSR Ser Khim BAS USSR Chem Sci	3484	2417	1250	69.4	35.9	51.7	0.799
11.	Zh Neorg Khim J Inorg Chem	3701	2343	1591	63.3	43.0	67.9	0.482
12.	Physical Review Letters	27909	2233	—	8.0	—	—	4.962
13.	Nature	64211	2028	—	3.2	—	—	4.228

Figure 9.51 Journals cited most frequently by Russian journals in 1972. A = citations from all journals. B = citations from Russian journals. C = self-citations. D = ratio of citations from Russian journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from Russian journals. G = overall impact.

14.	Optika Spektroskopiya Opt Spectrosc USSR	3376	1817	822	53.8	24.4	45.2	0.649
15.	J Biol Chem	75415	1700	—	2.3	—	—	5.565
16.	Zh Obshchei Khim J General Chem USSR	3434	1685	975	49.1	28.4	57.9	0.538
17.	Fix Tekh Popl Vodn Sov Phys Semicond	3463	1676	1402	48.4	40.5	83.6	1.530
18.	Fiz Met Metalloved Phys Met Metallogr USSR	3383	1506	516	44.5	15.3	34.3	1.003
19.	Zh Tekh Fiz Sov Phys Tech Phys	3731	1499	691	40.2	18.5	46.1	1.170
20.	IAN SSSR Ser Fiz B Acad Sci USSR Phys Sci	2039	1496	517	73.4	25.4	34.6	0.499
21.	Dokl Akad Nauk Arm SSR P Acad Sci Arm SSR	1442	1415	—	98.1	—	—	0.202
22.	Biochim Biophys Acta	46413	1372	—	3.0	—	—	2.869
23.	J Phys Chem	20479	1344	—	6.6	—	—	2.320
24.	J Org Chem	21202	1276	—	6.0	—	—	1.569
25.	Vysokomol Soed High Mol Cpds	3113	1269	840	40.8	27.0	66.2	0.544
26.	Chem Berichte	13385	1266	—	9.5	—	—	1.652
27.	Zh Analit Khim J Analyt Chem USSR	2405	1134	813	47.2	33.8	71.7	1.008
28.	Yadernaya Fiz Sov J Nucl Phys	1873	1082	919	57.8	49.1	85.0	0.916
29.	Phys Status Solidi	5537	1081	—	19.5	—	—	1.896
30.	Kristallografiya Sov Phys Crystallogr	2318	1053	449	45.4	19.4	42.6	2.320
31.	Biokhimiya Biochemistry USSR	1608	1025	308	63.7	19.2	30.1	0.874
32.	Radiotekh Elektronika Radio Eng Electr Phys USSR	1199	1004	585	83.7	48.8	58.3	0.299
33.	Zh Strukt Khim J Struct Chem USSR	1584	919	414	58.0	26.1	45.0	0.790
34.	Uspekhi Fiz Nauk Sov Phys Uspekhi	2499	904	70	36.2	2.8	7.7	4.970
35.	Uspekhi Khimii Adv Chemistry	1456	892	144	61.3	9.9	16.1	1.747
36.	Astrophys J	17250	890	—	5.2	—	—	3.876
37.	Proc Nat Acad Sci USA	37917	868	—	2.3	—	—	8.288
38.	J Phys Soc Japan	6752	866	—	12.8	—	—	0.945
39.	J Roy Soc London A	12254	851	—	6.9	—	—	1.870
40.	Analyt Chemistry	18471	847	—	4.6	—	—	5.187
41.	Science	43107	845	—	2.0	—	—	4.399
42.	Zh Prikl Khim J Appl Chem USSR	1433	830	494	57.9	34.5	59.5	0.151
43.	Zh Mikrob Epidem Immun J Microb Epidem Immun USSR	942	818	649	86.8	68.9	79.3	0.247
44.	Izmertel Tekh Meas Tech USSR	863	789	737	91.4	85.4	93.4	0.109
45.	Biochemical J	32537	778	—	2.4	—	—	4.386
46.	J Phys Chem Solids	6134	774	—	12.6	—	—	1.646
47.	Ukrain Khim Zh Ukr Chem J	1059	773	310	73.0	29.3	78.4	0.287
48.	Teplofiz Vysok Temp High Temp USSR	922	727	570	78.9	61.8	78.4	0.773

49.	Trans Faraday Soc	11591	719	—	6.2	—	—	2.132
50.	Tsitologiya Cytology	846	719	466	85.0	55.1	64.8	0.383
51.	Zschr Physik	6959	716	—	10.3	—	—	1.309
52.	Acta Crystallogr	9753	713	—	7.3	—	—	2.464
53.	Antibiotiki Antibiotics	—	701	550	—	—	78.5	—
54.	Appl Phys Letters	7164	697	—	9.7	—	—	3.479
55.	J Molec Biol.	21939	693	—	3.2	—	—	7.647
56.	Biofizika Biophysics USSR	1086	692	306	63.7	28.2	44.2	0.852
57.	Kolloidnyi Zh Colloid J USSR	1334	674	347	50.5	26.0	51.5	0.550
58.	Philosophical Mag	7344	663	—	9.0	—	—	2.226
59.	Astronom Zh Sov Astronom J.	1452	641	167	44.2	11.5	26.1	1.079
60.	IVUZ Fizika B Inst Higher Educ Phys	654	622	390	95.1	59.6	62.7	0.270
61.	Teploenergetika Therm Eng USSR	996	613	535	61.6	53.7	87.3	0.507
62.	Bull Soc Chim Fr	9549	599	—	6.3	—	—	1.139
63.	Genetika Genetics USSR	1092	585	458	53.6	41.9	78.3	0.509
64.	Biull Eksp Biol Med B Exp Biol USSR	1379	584	313	42.4	22.7	53.6	0.294
65.	Tetrahedron Letters	16655	581	—	3.5	—	—	2.084
66.	J Bacteriology	16635	578	—	3.4	—	—	2.647
67.	Phys Rev A Gen Phys	7238	551	—	7.6	—	—	2.864
68.	Inorganic Chemistry	12707	547	—	4.3	—	—	2.842
69.	Zschr Anorg Allg Chem	4795	547	—	11.4	—	—	0.986
70.	Acta Metallurgica	5158	541	—	10.5	—	—	2.033
71.	Tetrahedron	9202	539	—	5.9	—	—	1.832
72.	Geokhimiya	—	535	373	—	—	69.7	0.049
73.	Zh Vys Nerv Deyatel Pavlov Pavlov J Higher Nerv Act	—	529	480	—	—	90.7	—
74.	Canad J Chem	9657	524	—	5.4	—	—	1.530
75.	Bull Chem Soc Japan	7906	514	—	6.5	—	—	1.086

Figure 9.51 (continued)

		A	B	C	D	E	F	G
1.	Dokl Akad Nauk Sssr	13013	3317	1424	25.5	10.9	42.9	0.353
2.	Vysokomol Soedin	7115	2836	1809	39.9	25.4	63.8	0.460
3.	Fiz Tverd Tela	7554	2768	1267	36.6	16.8	45.8	0.538
4.	Zh Obshch Khim	6290	2587	1411	41.1	22.4	54.5	0.763
5.	Zh Neorganich Khimii	5827	2554	1671	43.8	28.7	65.4	0.497
6.	Zh Eksp Teor Fiz	6043	2194	1457	36.3	24.1	66.4	1.195
7.	Zh Org Khim	6026	2083	1091	34.6	18.1	52.4	0.649
8.	Zh Fiz Khim	5423	2027	1082	37.4	20.0	53.4	0.333
9.	Sov Phys Semicond	7174	2007	943	28.0	13.1	47.0	0.488
10.	Usp Khim	12319	1831	113	14.9	0.9	6.2	1.079
11.	Opt Spektrosk	4467	1691	923	37.9	20.7	54.6	0.496
12.	Zh Tekhn Fiz	3366	1445	731	42.9	21.7	50.6	0.375
13.	Fiz Metal Metalloved	4026	1421	777	35.3	19.3	54.7	0.454
14.	Jetp Lett-Ussr	2807	1266	509	45.1	18.1	40.2	0.549
15.	Sov J. Nucl Phys	5667	1250	611	22.1	10.8	48.9	0.549
16.	Khim Geterotsikl	3678	1216	613	33.1	16.7	50.4	0.473
17.	Izv An Sssr Khim	2956	1209	551	40.9	18.6	45.6	0.595
18.	Usp Fiz Nauk	5957	1185	148	19.9	2.5	12.5	1.514
19.	J Organomet Chem	26699	1159	--	4.3	--	--	2.392
20.	Izv An Sssr Ser Fiz	4871	1115	517	22.9	10.6	46.4	0.440
21.	Izv Vyss Uch Zav Fiz	2929	1002	292	34.2	10.0	29.1	0.163
22.	Phys Rev. B	27280	928	--	3.4	--	--	2.864
23.	Anal Chem	27658	908	--	3.3	--	--	3.291
24.	Ukr Khim Zh	2288	884	245	38.6	10.7	27.7	0.204
25.	Zh Mikrob Epid Immun	4724	867	683	18.4	14.5	78.8	0.271
26.	Kristallografiya	2311	822	362	35.6	15.7	44.0	0.518
27.	Zavodskaya Laborator	2425	807	412	33.3	17.0	51.1	0.324
28.	Tsitologiya	3955	789	456	19.9	11.5	57.8	0.395
29.	Radiotekh Elektron	2209	784	560	35.5	25.4	71.4	0.244
30.	Antibiotiki	2286	762	590	33.3	25.8	77.4	0.451
31.	Genetika	4834	740	539	15.3	11.2	72.8	0.474
32.	Phys Status Solidi B	9465	725	--	7.7	--	--	1.113
33.	Zh Prikl Khim	1976	725	281	36.7	14.2	38.8	0.106
34.	Prib Techn Eksp	2166	693	448	32.0	20.7	64.7	0.221
35.	Zh Anal Khim	1732	649	330	37.5	19.1	50.9	0.933
36.	Khim Prir Soedin	1722	619	463	35.9	26.9	74.8	0.414
37.	Biofizika	1985	590	335	29.7	16.9	56.8	0.717
38.	J Appl Chem--London	1409	587	--	41.7	--	--	--
39.	Zh Vysh Nerv Deyat	2550	562	486	22.0	19.1	86.5	0.373
40.	Phys Status Solidi A	9410	515	--	5.5	--	--	0.935

Figure 9.52 Major sources of reference to Russian journals in 1974. A = references to all journals. B = references to Russian journals. C = references to self. D = ratio of Russian references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to Russian references. G = overall impact.

41.	Bunseki Kagaku	12285	462	--	3.8	--	--	0.384
42.	Ukr Biokhim Zh	2224	446	209	20.1	9.4	46.9	0.332
43.	Astron Zh	2142	441	321	20.6	15.0	72.8	0.435
44.	Phys Rev A	13126	427	--	3.3	--	--	2.613
45.	Sov Phys Acoustics	1577	423	245	26.8	15.5	57.9	2.612
46.	Arm Khim Zh	969	399	202	41.2	20.9	50.6	0.309
47.	Farmakol I Toksikol	2684	398	192	14.8	7.2	48.2	0.208
48.	J Chem Phys	33404	397	--	1.2	--	--	2.918
49.	Nucl Phys A	18463	378	--	2.0	--	--	2.423
50.	Phys Rev Lett	11203	354	--	3.2	--	--	5.059
51.	Kolloidnyi Zh	791	339	156	42.9	19.7	46.0	0.254
52.	Vop Virusol	1774	319	244	18.0	13.8	76.5	0.521
53.	Khim Farm Zh	1156	311	155	26.9	13.4	49.8	0.273
54.	Vestn Mosk U Khim	921	310	105	33.7	11.4	33.9	0.228
55.	Phys Rev D	16727	303	--	1.8	--	--	2.723
56.	Vop Med Khim	2196	302	96	13.8	4.4	31.8	0.166
57.	Talanta	3454	283	--	8.2	--	--	1.787
58.	Pure Appl Chem	3151	280	--	8.9	--	--	1.695
59.	Izv An Sssr Biol	2280	278	90	12.2	4.0	32.4	0.300
60.	J Am Chem Soc	46267	252	--	0.5	--	--	4.383
61.	Zh Strukt Khim	1009	248	131	24.6	13.0	52.8	0.687
62.	Dopov Akad Nauk A	1100	247	75	22.5	6.8	30.4	0.056
63.	Zh Obshchei Biologii	1930	235	112	12.2	5.8	47.7	0.277
64.	Mol Biologiya	964	224	88	23.2	9.1	39.3	0.509
65.	Dokl Akad Nauk Bssr	921	211	72	22.9	7.8	34.1	0.070
66.	Phys Rev C	13095	207	--	1.6	--	--	2.299
67.	B Eks Biol Med	1333	199	95	14.9	7.1	47.7	0.183
68.	J. Org Chem	21976	188	--	0.9	--	--	1.495
69.	Phys Fluids	4815	187	--	3.9	--	--	1.181
70.	Biokhimiya	1067	185	101	17.3	9.5	54.6	0.526
71.	P I Elec Elec Eng	5001	184	--	3.7	--	--	2.013
72.	J Chromatogr	11520	182	--	1.6	--	--	2.173
73.	B Soc Chim Fr	11102	177	--	1.6	--	--	1.001
74.	J. Electroanal Ch Inf	6769	176	--	2.6	--	--	1.567
75.	Synthesis	4649	175	--	3.8	--	--	1.342

Figure 9.52 (continued)

		A	B	C	D	E	F	G
1.	Dokl Akad Nauk Sssr	10072	5635	1424	55.9	14.1	25.3	0.353
2.	J Am Chem Soc	98995	4847	--	4.9	--	--	4.383
3.	Zh Eksp Teor Fiz	7753	4670	1457	60.2	18.9	31.2	1.195
4.	Phys Rev	50828	4054	--	8.0	--	--	--
5.	Fiz Tverd Tela	4497	3041	1267	67.6	28.2	41.7	0.538
6.	Zh Obsch Khim	4615	2835	1411	61.4	30.6	49.8	0.763
7.	Zh Neorganich Khimii	3538	2545	1671	71.9	47.2	65.7	0.497
8.	Zh Fiz Khim	3608	2431	1082	67.4	30.0	44.5	0.333
9.	J. Chem Phys	62041	2727	--	4.4	--	--	2.918
10.	Vysokomol Soedin	3047	2203	1809	72.3	59.4	82.1	0.460
11.	Fiz Tekh Poluprovodn	2101	1794	1476	85.4	70.3	82.3	0.731
12.	Phys Rev Lett	29275	1792	--	6.1	--	--	5.059
13.	J Appl Phys	19277	1703	--	8.8	--	--	1.558
14.	Zh Org Khim	2202	1674	1091	76.0	49.5	65.2	0.649
15.	Pisma Zh Eksp Teor	1879	1643	522	87.4	27.8	31.8	1.001
16.	Opt Spektrosk	2396	1627	923	67.9	38.5	56.7	0.496
17.	Izv An Sssr Khim	2825	1572	551	55.6	19.5	35.1	0.595
18.	Nature	59206	1500	--	2.5	--	--	3.636
19.	J Chem Soc	19955	1487	--	7.5	--	--	--
20.	J Biol Chem	81354	1388	--	1.7	--	--	5.843
21.	Zh Tekhn Fiz	1659	1245	731	75.0	44.1	58.7	0.375
22.	Fiz Metal Metalloved	1649	1226	777	74.3	47.1	63.4	0.454
23.	Biochim Biophys Acta	51491	1221	--	2.4	--	--	3.120
24.	Yadernaya Fizika	1807	1181	913	65.4	50.5	77.3	0.818
25.	Izv An Sssr Ser Fiz	1724	1169	517	67.8	30.0	44.2	0.440
26.	J Organ Chem	20539	1142	--	5.6	--	--	1.495
27.	Chem Ber	12629	1140	--	9.0	--	--	1.493
28.	Usp Fiz Nauk	1404	993	148	70.7	10.5	14.9	1.514
29.	J Phys Chem--Us	18086	931	--	5.1	--	--	2.031
30.	Prib Techn Eksp	1056	899	448	85.1	42.4	49.8	0.221
31.	Khim Geterotsikl	1095	894	613	81.6	56.0	68.6	0.473
32.	Phys Rev B	16104	877	--	5.4	--	--	2.864
33.	Zh Anal Khim	2440	864	330	35.4	13.5	38.2	0.933
34.	P Nat Acad Sci Usa	46917	854	--	1.8	--	--	8.989
35.	Usp Khim	1093	829	113	75.8	10.3	13.6	1.079
36.	Kristallografiya	1175	820	362	69.8	30.8	44.1	0.518
37.	Zh Mikrob Epid Immun	939	793	683	84.5	72.7	86.1	0.271
38.	Zavodskaya Laborator	1458	777	412	53.3	28.3	53.0	0.324
39.	Radiotekh Elektron	898	769	560	85.6	62.4	72.8	0.244
40.	Nucl Phys A	12176	714	--	5.9	--	--	2.423

Figure 9.53 Journals cited most frequently by Russian journals in 1974. A = citations from all journals. B = citations from Russian journals. C = self-citations. D = ratio of citations from Russian journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from Russian journals. G = overall impact.

41.	Biokhimiya	1419	696	101	49.0	7.1	14.5	0.526
42.	J Bacteriol	18375	682	--	3.7	--	--	2.727
43.	Genetika	886	681	539	76.9	60.8	79.1	0.474
44.	Astrophys J	22201	673	--	3.0	--	--	4.063
45.	Phys Status Solidi	4382	665	--	15.2	--	--	--
46.	Antibiotiki	849	661	590	77.9	69.5	89.3	0.451
47.	Science	47505	657	--	1.4	--	--	5.412
48.	Tetrahedron Lett	16509	654	--	4.0	--	--	1.777
49.	Zh Strukt Khim	1377	626	131	45.5	9.5	20.9	0.687
50.	J Phys Soc Japan	7914	626	--	7.9	--	--	1.132
51.	J Mol Biol	24209	623	--	2.6	--	--	7.502
52.	Appl Phys Lett	8625	617	--	7.2	--	--	3.220
53.	Tsitologiya	759	617	456	81.3	60.1	73.9	0.395
54.	Biochem J	31563	610	--	1.9	--	--	3.627
55.	P Roy Soc Lond a Mat	12224	607	--	5.0	--	--	2.215
56.	J Chem Soc--Chem Commun	14454	606	--	4.2	--	--	2.096
57.	Zh Prikl Khim	1361	559	281	41.1	20.6	50.3	0.106
58.	Anal Chem	18190	554	--	3.0	--	--	3.291
59.	Ukr Khim Zh	793	550	245	69.4	30.9	44.5	0.204
60.	Inorg Chem	14310	542	--	3.8	--	--	2.457
61.	Khim Prir Soedin	736	531	463	72.1	62.9	87.2	0.414
62.	Phys Lett B	9958	527	--	5.3	--	--	0.373
63.	Zh Vysh Nerv Deyat	636	525	486	82.5	76.4	92.6	0.373
64.	Biofizika	897	517	335	57.6	37.3	64.8	0.717
65.	J Polymer Sci	4385	516	--	11.8	--	--	--
66.	Kinet Katal	--	514	--	--	--	--	--
67.	Tetrahedron	8903	512	--	5.8	--	--	1.576
68.	J Phys Chem Solids	5766	508	--	8.8	--	--	1.394
69.	Akust Zh	549	501	434	91.3	79.1	86.6	0.605
70.	Z Phys	6662	497	--	7.5	--	--	1.340
71.	T Faraday Soc	8857	492	--	5.6	--	--	--
72.	Can J Chem	9142	490	--	5.4	--	--	1.396
73.	Kolloidnyi Zh	876	489	156	55.8	17.8	31.9	0.254
74.	Ann Chem Just Lieb	6177	481	--	7.8	--	--	1.024
75.	Philosophical Mag	7063	476	--	6.7	--	--	1.836

Figure 9.53 (continued)

Journals	A	B	C	D	E	F	G
1. Dokl Akad Nauk SSSR Proc Acad Sci USSR	7647	2106	837	27.5	11.0	39.7	0.572
2. Fiz Tverdogo Tela Sov Phys Solid State	3704	1853	1114	50.0	30.1	60.1	2.046
3. Zh Eksp Teor Fiz Sov Phys JETP	3170	1769	1141	55.8	36.0	64.5	3.944
4. Zh Fiz Khim Russ J Phys Chem	2527	1112	796	44.0	31.5	71.6	0.838
5. Yadernaya Fiz Sov J Nucl Phys	2225	868	463	39.0	20.8	53.3	2.054
6. Usp Fiz Nauk Sov Phys Uspękhi	2140	802	103	37.5	4.9	12.8	4.930
7. Physical Review	14496	701	—	4.8	—	—	3.679
8. Fiz Tekh Popl Vodn Sov Phys Semicond	1278	634	253	49.6	19.8	39.9	1.741
9. Vysomolek Soed A High Mol Cpds A	1750	585	289	33.4	16.5	49.4	0.559
10. Zh Eksp Teor Fiz P JETP Letters	1070	560	230	52.3	21.5	41.7	2.240
11. Zh Tekh Fiz Sov Phys Tech Phys	1032	546	381	52.9	36.9	69.8	1.322
12. Radiotekh Elektronika Radio Eng Electr Phys USSR	1451	518	380	35.7	26.2	73.4	0.756
13. Zavod Lab Indust Lab USSR	1217	402	301	33.0	24.7	74.9	0.178
14. Phys Status Solidi	4973	382	—	7.7	—	—	1.578
15. Astronom Zh Sov Astronomy Journal	1106	380	291	34.4	26.3	76.6	1.635
16. IAN USSR Ser Fiz B Acad Sci USSR Phys Ser	1568	339	140	21.6	8.9	41.3	0.807
17. IVUZ Fizika B Inst Higher Ed Phys	1285	330	67	25.7	5.2	20.3	—
18. Teploenergetika Therm Eng USSR	770	326	275	42.3	35.7	84.4	0.572
19. Fiz Met Metaloved Phys Met Metallogr USSR	764	272	160	35.6	20.9	58.8	0.872
20. Optika Spektroskopiya Opt Spectrosc USSR	1561	247	—	15.8	—	—	1.331
21. Indust Eng Chem	2952	219	—	7.4	—	—	1.123
22. IAN Fiz Atmos Okeana BAS USSR, Atmos Oceanic Phys	747	216	117	28.9	15.7	54.2	0.961
23. Svar Proiz Weld Prod USSR	498	216	209	43.4	42.0	96.8	—
24. Kristallografiya Sov Phys Crystallogr	490	213	147	43.5	30.0	69.0	1.339
25. Stal Stal in Engl USSR	502	192	177	38.2	35.3	92.2	0.124
26. Teplofiz Vysok Temp High Temp USSR	994	189	139	19.0	14.0	73.5	0.423
27. Izmeritel Tekh Meas Tech USSR	525	189	186	36.0	35.4	98.4	0.163
28. Nuclear Physics A	5011	174	—	3.4	—	—	0.858
29. Atomnaya Energiya Sov Atomic Energy	1133	171	65	15.1	5.7	38.0	0.479

Figure 9.54 Major sources of references to Russian journals in 1969. A = references to all journals. B = references to Russian journals. C = references to self. D = ratio of Russian references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to Russian references. G = overall impact.

30.	Avtomat Telemekh Automat Rem Contr USSR	437	167	138	38.2	31.6	82.6	0.340
31.	J Apllied Physics	5811	174	—	2.9	—	—	1.936
32.	Okeanologiya Oceanology	620	160	92	25.8	14.8	57.5	0.577
33.	Fiz Goreniya Vzryva Comb Expl Shock Waves	345	152	33	44.1	9.6	21.7	—
34.	Organometal Chem Rev B 1961	1961	151	—	7.7	—	—	—
35.	Zh Prikl Mekh J Appl Mech Tech Phys	451	149	119	33.0	26.4	79.9	0.491
36.	Biofizika Biophysics USSR	607	145	72	23.9	11.9	49.7	0.414
37.	Kolloidnyi Zh Colloid Journal USSR	364	144	86	39.6	23.6	59.7	0.574
38.	Prib Tekh Eksp Instr Exp Techn USSR	1513	144	9	9.5	0.6	6.3	0.357
39.	Physical Review Letters	3230	144	—	4.5	—	—	5.114
40.	Akust Zh Sov Phys Acoustics	351	144	123	41.0	35.0	85.4	1.017
41.	Radiotekhnika Telecomm Radio Eng USSR	738	140	48	19.0	6.5	34.3	—
42.	J Chem Phys	10710	137	—	1.3	—	—	3.180
43.	Zh Nauch Prikl Foto J Sci Appl Photogr	418	135	76	32.2	18.2	56.3	0.400
44.	Vestn Mashinostroeniya Russ Eng J	382	131	131	34.3	34.3	100.0	0.557
45.	Eur Polymer J	1308	125	—	9.6	—	—	—
46.	Bull Soc Chim Fr	6283	112	—	1.8	—	—	1.147
47.	Geokhimiya Geochemistry Internat	1356	105	19	7.7	1.4	18.1	—
48.	IAN SSSR Metally Russian Metallurgy (Metally)	446	101	—	22.7	—	—	—
49.	Dokl Soil Sci	502	100	60	19.9	12.0	60.0	0.099
50.	Nauchno-tekhn Inf 1 Sci Techn Inf	418	100	72	23.9	17.2	72.0	
51.	Novo Cimento	3834	100	—	2.6	—	—	0.527
52.	Chemical Reviews	2597	94	—	3.7	—	—	8.680
53.	Ann Rev Nucl Sci	1891	95	—	5.0	—	—	5.629
54.	Physics of Fluids	1512	92	—	6.1	—	—	1.581
55.	J Org Chem	6848	91	—	1.3	—	—	2.407
56.	Koks Khim Coke and Chemistry USSR	328	86	66	26.2	20.12	76.7	0.239
57.	Biull Eksp Biol Med B Exp Biol USSR	430	84	57	19.5	13.2	67.9	0.094
58.	Annu Rep Progr Chem B	5091	83	—	1.6	—	—	—
59.	J Phys Soc Japan	2119	75	—	3.5	—	—	1.045
60.	J Am Chem Soc	10135	70	—	0.7	—	—	5.859
61.	Progr Theoret Phys	1924	70	—	3.6	—	—	1.513
62.	J Phys Chem	4873	68	—	1.4	—	—	2.429
63.	Naturwissenschaften	1574	65	—	4.1	—	—	0.920
64.	Physics Letters	1702	65	—	3.8	—	—	1.654
65.	Annu Rev Fluid Mech	943	64	—	6.8	—	—	—
66.	J Electrochem Soc	1514	61	—	4.0	—	—	0.797
67.	Appl Spectrosc Rev	593	60	—	10.1	—	—	—

Figure 9.54 (continued)

68.	Tekhn Kibernetika	267	60	—	22.4	1.0	7.0	—
69.	Space Sci Rev	1192	60	—	5.0	—	—	2.492
70.	J Inorg Nucl Chem	1839	55	—	3.0	—	—	1.535
71.	J Electroanalyt Chem	1066	54	—	5.1	—	—	1.724
72.	J Polymer Sci Al	1761	52	—	3.0	—	—	1.039
73.	Inorg Chem	3353	51	—	1.5	—	—	3.296
74.	J Chem Soc	3802	49	—	1.3	—	—	3.123
75.	Astrophysical J	3799	48	—	1.3	—	—	4.972

Journal	A	B	C	D	E	F	G
1. Zh Eksp Teor Fiz Sov Phys JETP	4213	2619	1141	62.2	27.1	43.6	3.944
2. Physical Review	20666	2019	—	9.8	—	—	3.679
3. Fiz Tverdoga Tela Sov Phys Solid State	2605	1876	1114	72.0	42.8	59.4	2.046
4. Dokl Akad Nauk SSSR Proc Acad Sci USSR	3103	1723	837	55.5	27.0	48.6	0.572
5. Zh Fiz Khim Russ J Phys Chem	1385	985	796	71.1	57.5	80.8	0.838
6. Zh Tekh Fiz Sov Phys Tech Phys	912	645	381	70.7	41.8	59.1	1.322
7. Optika Spektroskopiya Opt Spectrosc USSR	1050	641	458	61.1	43.6	71.5	1.331
8. Zh Eksp Teor Fiz P JETP Letters	756	595	230	78.7	30.4	38.7	2.240
9. Yadernaya Fiz Sov J Nucl Phys	734	592	463	80.7	63.1	78.2	2.054
10. Radiotekh Elektronika Radio Eng Electr Phys USSR	575	535	380	93.0	66.1	71.0	0.756
11. Prib Tekh Eksp Instr Exp Techn USSR	559	528	469	94.5	83.9	88.8	0.357
12. Physical Review Letters	6544	500	—	7.6	—	—	5.114
13. J Appl Phys	5274	483	—	9.2	—	—	1.936
14. J Chem Phys	13687	482	—	3.5	—	—	3.180
15. Usp Fiz Nauk Sov Phys Uspekhi	634	401	103	63.3	16.3	25.7	4.930
16. Nuclear Physics	2539	370	—	14.6	—	—	0.858
17. Vysokomolek Soed Polymer Sci USSR	565	344	289	60.9	51.2	84.0	0.559
18. Zavod Lab Indust Lab USSR	474	336	301	70.9	63.5	89.6	0.178
19 Astronom Zh Sov Astronomy Journal	541	332	291	61.4	53.8	87.7	1.635
20. J Amer Chem Soc	26307	327	—	1.2	—	—	5.859
21. Fiz Tekh Poluprovod Sov Phys Semiconduct USSR	387	326	253	84.2	65.4	77.6	1.741
22. IAN SSSR Ser Fiz B Acad Sci USSR Phys Ser	450	323	140	71.8	31.1	43.3	0.807
23. Geokhimiya Geochemistry Internat USSR	342	300	262	87.7	76.6	87.3	—

Figure 9.55 Journals cited most frequently by Russian journals in 1969. A = citations from all journals. B = citations from Russian journals. C = self-citations. D = ratio of citations from Russian journals to citations from all journals. E = ratio of self-citations to citations from all journals (self- cited rate). F = ratio of self-citations to citations from Russian journals. G = overall impact.

24.	Fiz Met Metaloved Phys Met Metallogr USSR	478	294	160	61.5	33.5	54.4	0.872
25.	Teploenergetika Therm Eng USSR	336	281	275	83.6	81.9	97.9	0.572
26.	Physics Letters	3295	280	—	8.5	—	—	1.654
27.	Kristallografiya Sov Phys Crystallogr	468	278	147	59.4	31.4	52.9	1.339
28.	Nature	15310	225	—	1.5	—	—	2.244
29.	J Polymer Sci	2893	198	—	6.8	—	—	1.039
30.	Avtomat Telemekh Automat Rem CONTR USSR	277	193	138	69.7	48.9	71.5	0.340
31.	Izmertel Tekh Meas Tech USSR	207	193	186	93.2	89.9	96.4	0.163
32.	Nuovo Cimento	2442	188	—	7.7	—	—	0.527
33.	J Phys Chem	4678	176	—	3.8	—	—	2.429
34.	Proc Roy Soc London	4693	171	—	3.6	—	—	2.998
35.	IEEE Trans	763	167	—	21.9	—	—	—
36.	J Phys Chem Solids	1419	163	—	11.5	—	—	2.073
37.	Zschr Physik	1759	162	—	9.2	—	—	1.536
38.	Philosophical Magazine	1924	157	—	8.2	—	—	2.251
39.	J Phys Soc Japan	1733	142	—	8.2	—	—	1.045
40.	Teplofiz Vysok Temp High Temp USSR	162	142	135	87.7	83.3	95.1	0.423
41.	Kolloidnyi Zh Colloid Journal USSR	165	140	86	84.9	52.1	61.4	0.574
42.	Phys Status Solidi	1313	139	—	10.6	—	—	1.578
43.	Astrophysical J	4258	136	—	3.2	—	—	4.972
44.	J Physics	3181	136	—	4.3	—	—	1.405
45.	Pro IEEE	1601	136	—	8.5	—	—	1.372
46.	Prikl Mat Mekh PMM J Appl Math Mech	194	126	119	65.0	61.3	94.4	0.491
47.	J Chem Soc	13978	122	—	0.9	—	—	3.123
48.	IAN Fiz Atmos Okeana B Acad Sci USSR Atmos Oceanic Phys.	127	117	117	92.3	92.3	100.0	0.961
49.	Okeanologiya	114	107	89	93.9	78.1	83.2	0.577
50.	Appl Phys Letters	1318	105	—	8.0	—	—	3.688
51.	Avtomat Svarka Automatic Welding USSR	217	105	105	48.4	48.4	100.0	0.315
52.	Vestn Mashinostroeniya Russ Eng J	134	105	105	78.4	78.4	100.0	0.557
53.	Biofizika Biophysics USSR	157	101	72	64.3	45.9	71.3	0.414
54.	IAN USSR Ser Khim. B Acad Sci USSR Chem Ser	362	97	—	26.8	—	—	0.547
55.	IAN USSR B. Acad Sci USSR	70	93	—	33.2	—	—	0.155
56.	Atomnaya Energiya Sov Atomic Energy	249	92	42	37.0	16.9	45.7	0.479
57.	Akust Zh Sov Phys Acoustics	213	90	74	42.3	34.7	82.2	—
58.	Trans Faraday Soc	2911	88	—	3.0	—	—	2.149
59.	Zh Nauch Prikl Fotogr J Sci Appl Photogr Cin	96	85	76	88.5	79.2	89.4	0.400
60.	Rev Modern Physics	1353	81	—	6.0		—	4.508
61.	Canad J Physics	1323	77	—	5.8	—	—	2.186

Figure 9.55 (continued)

62.	Rev Sci Instr	1223	77	—	6.3	—	—	0.868
63.	Acta Metallurgica	1304	76	—	5.9	—	—	2.278
64.	Ann Physics	1096	72	—	6.6	—	—	3.188
65.	Analyt Chem	4219	69	—	1.6	—	—	1.661
66.	Biochim Biophys Acta	9500	68	—	0.7	—	—	3.287
67.	Zh Org Chim J Org Chem. USSR	151	68	—	45.0	—	—	0.185
68.	IVUZ Fizika B Inst Higher Ed Phys	92	67	67	72.8	72.8	100.0	—
69.	Science	9739	67	—	0.7	—	—	2.894
70.	Comptes Rendus	5472	66	—	1.2	—	—	0.780
71.	IAN SSSR Metally Russian Metallurgy (Metally)	114	66	—	57.9	—	—	0.429
72.	J Geophys Res	3556	65	—	1.8	—	—	3.665
73.	Biull Eksp Biol Med B Exp Biol USSR	87	64	44	73.6	65.5	89.1	0.094
74.	Electrosvyaz	72	61	41	84.7	56.9	67.2	—
75.	J Opt Soc Amer	1597	60	—	3.8	—	—	0.962

Figure 9.55 (continued)

Figures 9.50 and 9.52, the lists of journals that were the major sources of references that cited the core group during the two years studied. Figure 9.50 shows that 17 of the top 75 sources in 1972 were non-Russian. Figure 9.52 shows that in 1974 the number of major non-Russian sources rose slightly to 21 out of 75. However, if you look at the number of citations received from non-Russian journals (rather than the number of journals) as a percentage of total citations received, you find that the utility of Russian journals by non-Russian scientists held about steady. In 1972, the non-Russian journals accounted for 15% of the source group's citations to the Russian journals. In 1974, the figure was still only 14%, which is a negligible decrease. Looking at it the other way, the Russian core journals also accounted for the same percentage of the total citations originating in the non-Russian journals in the two years studied. In 1972, the non-Russian journals published 265,221 references, of which 4% cited the Russian core journals. In 1974, the total number of references published rose to 323,189, of which 3% cited the Russian core journals.

The analysis of the journals cited most by the core group showed the same story. Figure 9.51 shows that 35 of the 75 journals cited most by the Russian core group in 1972 were non-Russian. Figure 9.53 shows that the figure remained substantially the same, 36, in 1974. The core-group percentage of total citations to the non-Russian journals accounted for 5% of the total citations received by the non-Russian journals; the figure for 1974 was 4%.

Although the analysis of the 1972 and 1974 lists didn't show any significant change in the degree of interaction between the Russian literature and the literature of other countries, an extension of the analysis back to 1969 did suggest that the orientation of the Russian literature has changed. The lists of journals that were the main sources and targets of the core-group citations in 1969 (Figures 9.54 and 9.55) showed a heavy orientation toward physics, chemistry, and their technologies. The

lists for 1972 (Figures 9.52 and 9.53), particularly the most frequently cited list (Figure 9.53), showed a moderation of the orientation, manifested by the increasing prominence of biomedical journals. For example, *Nature* improved its ranking on the most frequently cited list from twenty-eighth in 1969 (Figure 9.55) to thirteenth in 1972 (Figure 9.53). The *Journal of Biological Chemistry,* which didn't even rank among the 75 journals cited most often in 1969, showed up in the fifteenth position in 1972. The evidence points in the direction of a definite shift in the emphasis of Soviet research.

French Journal Literature (29)

A similar study of French journals was conducted with the 1974 data from a core group of 129 journals published in France. Again, it should be remembered that the study did not include data on material published by French scientists in "outside" journals, and to that extent it cannot be considered definitive. Nevertheless, the major journals published in France certainly publish a large-enough percentage of the work of French scientists to be roughly representative of French science.

First, some statistics to put the French journal literature into a worldwide perspective. The 129 French journals used as a core group in the study represented about 5.3% of the journals indexed by *SCI* in 1974 and accounted for 3.8% of the source items indexed and 2.6% of the references contained in those items. Although the average source item contained 13 references, the average French source item contained only 8.8.

If the French literature conformed to the international pattern of scientific and technical literature, the list of journals it cited most frequently (Figure 9.56) would have corresponded roughly to the list of journals cited most frequently by all the scientific and technical literatures in 1974. For example, the journal most highly cited by an aggregation of all the literatures in 1974 was the *Journal of the American Chemical Society.* All things being equal, it should also have been the journal most highly cited by the French core group; and, in fact, it did rank first in Figure 9.56. Since the core group contributed 2.6% of the references processed for *SCI* in 1974, it should have accounted for roughly the same percentage of the citations received by *JACS* in that year. And again, it did, accounting for 2.555% of the references that cited *JACS* material.

With the second item on the list, however, the picture changes radically. The journal second most frequently cited by the core group was *Bulletin de la Societe Chemique de France,* which was cited by all the journals covered by *SCI* a total of 6671 times. If the French average of accounting for 2.6% of all references held true, 173 of the citations received by the *Bulletin de la Societe Chemique de France* would have originated in references published by the core group. The analysis showed, however, that the core group accounted for 2471 of the citations, or 37% of the total citation count. Column D in Figure 9.56, which shows the references by the core group as a percentage of the total citation rate of each journal, makes it easy to see

where the core group's reference rate varied from its average 2.6% contribution. Obviously, some variation is to be expected, but contributions of 10% or more certainly seem to be a variation of consequence. Interestingly enough, variations of this magnitude occurred in 12 cases, and 11 of them were French journals. Also interesting is the fact that all 11 of these French journals were characterized by a high self-cited rate and a low impact factor.

It would be reasonable to conclude that the 11 journals owed their position on the list to an understandable preference of French scientists for the French language. But if that is so, why are there not more French journals, and why are the impact factors of the journals that are there so low? Even the combination of high self-cited rates and above average reference rates from the core group did not succeed in raising the impact factors to a more respectable level. The language-preference explanation is further weakened by comparing the ranking of the journals on this list with their ranking on an international list. The latter ranking is shown in Figure 9.56 in parenthesis after the journal-title abbreviation. If the language factor is responsible for raising *(Nouvelle) Press Medicale* from three hundred sixty-fifth on the international list to sixth on the French list, why does *Lancet* rank fifth on the French list?

Figure 9.57 shows that most of the references that cited the core group came from French journals and that the self-citing rate of these journals was unusually high. In addition, the list differed significantly from *SCI*'s international list. Only four or five of the major sources of citations to the French journals could be considered physics journals, whereas double that number appeared on the 1974 international list of major reference sources. The same discrepancy showed up on the most cited list.

Overall, the analysis showed the French literature as having relatively little impact on the international community—and even on the French community. The core group cited foreign literature much more than its own, even though its own literature is cited mainly by itself. The mathematics section (A) of the *Comptes Rendus* of the French Academy illustrated both sides of the coin. The entry for it in Figure 9.57 shows that only 30.6% of its references cited journals in the French core group and that most of them (80.6%) were self-citations. Figure 9.56, where it ranks twenty-fifth, shows that 71.3% of the citations it received originated in the core group; and, again, most of them were a function of self-citation.

Although the low impact that the French literature had upon the international community could be attributed to language, the high citation rates enjoyed by older French literature makes it seem unlikely. An additional analysis of core-group material that was cited more than 150 times between 1961 and 1974 turned up 13 items. The most significant characteristic of these itmes is that 11 were published before 1965. And it turned out that several of the articles, though published in French journals, were not written by French scientists.

	JOURNAL	A	B	C	D	E	F	G
1.	J. Amer. Chem. Soc. (1)	98995	2555	–	2.6	–	–	4.38
2.	B. Soc. Chim. France (95)	6671	2471	1700	37.0	25.5	68.8	0.77
3.	C. Rend. Acad. Sci.	8634	2106	626	24.4	7.3	29.7	–
4.	C. Rend. Acad. Sci. D Nat. (206)	3603	1758	1317	48.8	36.6	74.9	0.51
5.	Lancet (9)	37047	1451	–	3.9	–	–	6.67
6.	Nouv. Presse Medicale (365)	2908	1450	323	49.9	11.1	22.3	0.60
7.	Nature (4)	59206	1403	–	2.4	–	–	3.63
8.	J. Biol. Chemistry (2)	81354	1341	–	1.6	–	–	5.84
9.	Biochim. Biophys. Acta (5)	51487	1125	–	2.2	–	–	3.11
10.	New England J. Med. (13)	26726	1125	–	4.2	–	–	8.36
11.	C. Rend. Acad. Sci. C Chim (272)	2857	1082	573	37.9	20.1	53.0	0.51
12.	Circulation (38)	14461	1081	–	7.5	–	–	6.83
13.	J. Chemical Physics (3)	62040	1029	–	1.7	–	–	2.91
14.	J. Clin. Invest. (14)	24768	920	–	3.7	–	–	6.99
15.	Science (8)	46488	887	–	1.9	–	–	5.25
16.	P. Nat. Acad. Sci. USA (7)	46916	836	–	1.8	–	–	8.98
17.	J. Organic Chemistry (21)	20539	799	–	3.9	–	–	1.49
18.	Brit. Med. J. (18)	20700	798	–	3.9	–	–	3.54
19.	J. Amer. Med. Assoc. (30)	17211	748	–	4.3	–	–	3.06
20.	J. Chemical Society (22)	19955	748	–	3.7	–	–	–
21.	C. Rend. Soc. Biol. (283)	2742	698	232	25.5	8.5	33.3	0.30
22.	J. Chim. Physique (306)	2532	657	367	25.9	14.5	55.9	0.88
23.	Amer. J. Medicine (56)	9779	633	–	6.5	–	–	4.41
24.	Physical Review (6)	50842	631	–	1.2	–	–	–
25.	C. Rend. Acad. Sci. A Math (705)	844	602	474	71.3	56.2	78.7	0.20
26.	Tetrahedron Letters (31)	16478	589	–	3.6	–	–	1.77
27.	Biochemical Journal (10)	31563	585	–	1.9	–	–	3.62
28.	Arch. Maladies Coeur (711)	835	569	221	68.1	26.5	38.8	0.64
29.	Amer. J. Cardiology (93)	6811	554	–	8.1	–	–	3.70
30.	J. Urology (135)	5031	542	–	10.8	–	–	0.72
31.	Semaine Hopitaux (645)	974	541	125	55.5	12.8	23.1	0.29
32.	Annals Surgery (84)	7459	512	–	6.9	–	–	2.12
33.	Radiology (99)	6311	492	–	7.8	–	–	1.19
34.	Annals Internal Med. (50)	10231	489	–	4.8	–	–	4.82
35.	Gastroenterology (70)	8693	487	–	5.6	–	–	5.39
36.	P. Soc. Exp. Biol. Med. (28)	18167	477	–	2.6	–	–	1.46
37.	J. Cell Biology (24)	19103	474	–	2.5	–	–	6.77
38.	Amer. J. Roentg. (133)	5038)	469	–	9.3	–	–	1.00
39.	Amer. Heart J. (102)	5994	456	–	7.6	–	–	1.79
40.	C. Rend. Acad. Sci. B Phys. (456)	1522	451	302	29.6	19.8	67.0	0.44
41.	J. Molecular Biology (15)	24209	446	–	1.8	–	–	7.50
42.	J. Physical Chemistry (29)	18086	445	–	2.5	–	–	2.03
43.	Cancer (60)	9498	440	–	4.6	–	–	2.36
44.	Amer. J. Physiology (17)	21519	424	–	2.0	–	–	2.41
45.	Bioch. Bioph. Res. Comm. (16)	23136	422	–	1.8	–	–	3.73
46.	Biochemistry (12)	27080	421	–	1.6	–	–	4.71
47.	Phys. Rev. Letters (11)	29229	401	–	1.4	–	–	5.05
48.	J. Exp. Medicine (19)	20699	400	–	1.9	–	–	11.87
49.	J. Bacteriology (26)	18369	391	–	2.1	–	–	2.72
50.	Amer. J. Obst. Gyn. (66)	8866	389	–	4.4	–	–	2.09

Figure 9.56 Journals cited most frequently by French journals. A = citations from all journals. B = citations from French journals. C = self-citations. D = ratio of citations from French journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from French journals. G = overall impact. Figures in parentheses following the names of the journals show their ranks on ISI's international list of most highly cited journals.

	JOURNAL	A	B	C	D	E	F	G
1.	C. Rend. Acad. Sci. D Nat.	11129	1952	1317	17.5	11.8	67.5	0.51
2.	B. Soc. Chim. France	11102	1379	869	12.4	7.8	63.0	0.77
3.	C. Rend. Acad. Sci. C Chim.	4762	1151	573	24.2	12.0	49.8	0.51
4.	Semaine Hopitaux	5603	882	125	15.7	2.2	14.2	0.29
5.	Nouv. Presse Medicale	4900	801	323	16.3	6.6	40.3	0.60
6.	J. Organomet. Chem.	22699	655	–	2.9	–	–	2.38
7.	C. Rend. Acad Sci. A Math.	1924	588	474	30.6	24.6	80.6	0.20
8.	J. Chim. Physique	4489	556	367	12.4	8.2	66.0	0.88
9.	C. Rend. Acad. Sci. B Phys.	2243	466	302	20.8	13.5	64.8	0.44
10.	Analytical Chemistry	27658	435	–	1.6	–	–	3.29
11.	Tetrahedron	13059	404	–	3.1	–	–	1.57
12.	Ann. Chirurgie	1916	394	79	20.6	4.1	20.0	0.16
13.	C. Rend. Soc. Biol.	1926	367	232	19.1	12.0	63.2	0.30
14.	Lyon Medical	2771	365	49	13.2	1.8	13.4	0.24
15.	Arch. Maladies Coeur	2466	358	221	14.5	9.0	61.7	0.64
16.	J. Amer. Chem. Soc.	46267	343	–	0.7	–	–	4.38
17.	J. Chem. Soc. Perkin	20327	342	–	1.7	–	–	1.34
18.	J. Organic Chemistry	21976	326	–	1.5	–	–	1.49
19.	Revue Rhumatisme	1543	315	103	20.4	6.7	32.7	0.48
20.	Tetrahedron Letters	11178	269	–	2.4	–	–	1.77
21.	Pathologie Biologie	2866	252	49	8.9	1.7	19.4	0.56
22.	Lille Medicale	1842	249	41	13.5	2.2	16.5	0.13
23.	Canad. J. Chemistry	12685	240	–	1.9	–	–	1.39
24.	Biochimie	4677	236	154	5.0	3.3	65.3	1.63
25.	Neuro-Chirurgie	1363	230	66	16.9	4.8	28.7	0.36
26.	J. Radiol. Electrol.	1264	223	65	17.6	5.1	29.1	0.21
27.	Arch. Fr. Pediatrie	1642	215	72	13.1	4.4	33.5	1.01
28.	J. Chirurgie	1265	215	14	17.0	1.1	6.5	0.15
29.	J. Microscopie (Paris)	1634	212	129	13.0	7.9	60.8	1.60
30.	Eur. J. Med. Chem.	1541	207	112	13.4	7.3	54.1	–
31.	Brain Research	19626	198	–	1.0	–	–	3.10
32.	Ann. Cardiol. Angeiol.	1132	192	13	17.0	1.1	6.8	0.35
33.	Deut. Med. Wschr.	–	187	–	–	–	–	–
34.	Biochim. Biophys. Acta	45366	185	–	0.4	–	–	3.11
35.	Coeur Med. Interne	1308	184	30	14.1	2.3	16.3	0.53
36.	Physical Review B	27280	181	–	0.7	–	–	2.86
37.	Ann. Radiologie	1122	180	24	16.0	2.1	13.3	0.39
38.	J. Urologie Nephrol.	1171	180	107	15.4	9.1	59.4	0.18
39.	Cell Tissue Research	–	177	–	–	–	–	–
40.	J. Physique	1749	177	110	10.1	6.3	62.1	1.84
41.	Arch. Fr. Mal. App. Dig.	1556	172	58	11.1	3.7	33.7	0.72
42.	J. Chemical Physics	33404	172	–	0.5	–	–	2.91
43.	Uspekhi Khimii	12319	172	–	1.4	–	–	1.07
44.	Nouv. Revue Fr. Hemat.	1675	170	98	10.1	5.9	57.6	0.94
45.	Gen. Comp. Endocrinol.	3715	169	–	4.5	–	–	2.03
46.	Humangenetik	3820	165	–	4.3	–	–	1.70
47.	Revue Chir. Orthop.	688	157	70	22.8	10.2	44.6	0.17
48.	Therapie	1352	148	32	10.9	2.4	21.6	0.40
49.	B. Soc. Zool. France	–	147	30	–	–	20.4	–
50.	J. Electroanal. Chem.	6769	147	–	2.2	–	–	1.56

Figure 9.57 Major sources of references to French journals. A = references to all journals. B = references to French journals. C = references to self. D = ratio of French references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to French references. G = overall impact.

Japanese Journal Literature (30)

A study of the 79 Japanese journals covered by the 1974 *SCI* produced the results shown in Figures 9.58 and 9.59. As in all these studies of selected national literatures, only the journals published in the subject country, and only the work that the country's scientists published in those journals, were included. In this particular case, the coverage of the core group of journals was a bit less than complete in terms in citations. Because of the language problem, citations written in Japanese were not included. What effect this limitation had on the accuracy of the citation counts is unknown. All we know for sure on this subject is that very few of the core-group journals were published in only the Japanese language, and the average number of references per published item in the core-group journals matched the international average just on the strength of the references we did pick up.

The statistics on the relationship of the core group to the international literature are as follows: the group represented 3.2% of the international literature covered by *SCI* in 1974, published 2.7% of the source itmes processed, and produced 2.6% of the references picked up from those source items.

The first finding of the study was that the bibliographic law of concentration applies as much to the Japanese literature as it does to all the others. Though the core group cited 9600 different publications, the 50 cited most frequently (1% of the target group) accounted for 42% of the cited material. Conversely, the 50 major sources of references that cited the core group accounted for 43% of the citations received from 1576 different journals.

Using the core group's proportionate share of the international reference pool as a measure, we found (Figure 9.58) that the group cited the top-ranking *Journal of the American Chemical Society* somewhat more frequently than would be expected in a statistically ideal world: they accounted for 5.2% of its citations compared to their 2.6% share of the reference pool. Figure 9.59 shows that *JACS* did not return the compliment; only 0.8% of its 1974 references cited the 79 Japanese journals. In fact, about the only non-Japanese journal that cited the core group at a rate consistent with the group's 2.7% share of the international pool of source items was *Phytochemistry.*

Probably the most important finding (in terms of characterizing Japanese science) in the analysis of the journals most frequently cited by the core group (Figure 9.58) was the high rankings of the American Chemical Society journals, particularly those dealing with biochemistry. In contrast, *Nature, Science,* and the *Proceedings of the National Academy of Sciences USA* received notably less attention. This suggests a preponderance of chemical research in Japanese science. Another aspect of that characteristic is suggested by *Analytical Chemistry,* which not only ranked twelfth but also owed no less than 8% of its total citation rate to the Japanese core group. This is indicative of an intense interest in analytical methods, which could be considered a reflection of a strong orientation toward industrial development.

An interesting feature of the major sources of references that cite the core group (Figure 9.59) is the strong representation of occidental journals. Although the five major sources are Japanese journals, non-Japanese journals appear in substantial numbers, beginning with the triad of *Biochimica Biophysica Acta, Tetrahedron Letters,* and *Journal of Biological Chemistry,* throughout the remainder of the list.

Journal	A	B	C	D	E	F	G
1. J. Amer. Chem. Soc	98995	5115	– –	5.2	– –	– –	4.38
2. J. Biol. Chem.	81354	3192	– –	3.9	– –	– –	5.84
3. *Bull. Chem. Soc. Japan*	7936	2375	1386	29.9	17.5	58.4	0.93
4. J. Chem. Physics	62040	1764	– –	2.8	– –	– –	2.91
5. Biochim. Biophys. Acta	51487	1720	– –	3.3	– –	– –	3.11
6. *Chem. Pharmaceut. Bull.*	3477	1617	1076	46.5	30.9	66.5	0.93
7. Analyt. Chemistry	18190	1515	– –	8.3	– –	– –	3.29
8. *J. Phys. Soc. Japan*	7607	1500	1239	19.7	16.3	82.6	1.13
9. *J. Biochemistry Japan*	4765	1361	874	28.6	18.3	64.2	1.71
10. Tetrahedron Letters	16478	1343	– –	8.2	– –	– –	1.77
11. J. Organic Chem.	20539	1308	– –	6.4	– –	– –	1.49
12. *Progr. Theoret. Phys.*	3860	1301	1271	33.7	32.9	97.7	1.41
13. Physical Review	40815	1281	– –	3.1	– –	– –	– –
14. J. Chem. Soc. (London)	14604	1209	– –	8.3	– –	– –	– –
15. *Agric. Biol. Chem.*	2522	1171	796	46.4	31.6	68.0	0.96
16. Nature	59206	1137	– –	1.9	– –	– –	3.63
17. Biochem. J.	31563	1071	– –	3.4	– –	– –	3.62
18. Phys. Rev. Letters	39229	937	– –	3.2	– –	– –	5.05
19. J. Chromatography	7928	930	– –	11.7	– –	– –	2.17
20. J. Appl. Physics	19277	921	– –	4.8	– –	– –	1.55
21. Biochemistry	27080	890	– –	3.3	– –	– –	4.71
22. Biochem. Biophys. Res. Comm.	23136	828	– –	3.6	– –	– –	3.73
23. Proc. Nat. Acad. Sci. USA	46916	779	– –	1.7	– –	– –	8.98
24. J. Phys. Chemistry	18086	749	– –	4.1	– –	– –	2.03
25. J. Bacteriology	18369	729	– –	4.0	– –	– –	2.72
26. Science	46488	679	– –	1.5	– –	– –	5.25
27. Arch. Biochem. Biophys.	15072	672	– –	4.5	– –	– –	2.95
28. Chem. Berichte	9569	577	– –	6.0	– –	– –	1.46
29. Tetrahedron	8903	574	– –	6.4	– –	– –	1.57
30. Surface Science	4600	552	– –	12.0	– –	– –	3.34
31. Chem. Comm.	8457	525	– –	6.2	– –	– –	– –
32. Analyt. Chim. Acta	– –	523	– –	– –	– –	– –	0.10
33. *J. Antibiotics Tokyo*	1161	479	339	41.3	29.2	70.8	2.04
34. *Japan. J. Appl. Phys.*	1847	475	400	25.7	21.7	84.2	0.66
35. Helv. Chim. Acta	7117	472	– –	6.6	– –	– –	1.64
36. J. Pharmacol. Exp. Ther.	13753	468	– –	3.4	– –	– –	3.57
37. Analyt. Biochem.	10206	457	– –	4.5	– –	– –	2.37
38. Phys. Rev. B.	16094	437	– –	2.7	– –	– –	2.86
39. Proc. Roy. Soc. London A	12211	410	– –	3.4	– –	– –	2.20
40. Proc. Soc. Exp. Biol. Med.	18167	390	– –	2.1	– –	– –	1.46
41. *J. Pharmaceut. Soc. Japan*	1301	388	5	29.8	0.4	1.3	0.35
42. J. Molecular Biol.	24209	387	– –	1.6	– –	– –	7.50
43. *Chemistry Letters*	718	385	145	53.6	20.2	37.7	0.86
44. Angew. Chem. Int. Ed.	10579	384	– –	3.6	– –	– –	4.10
45. J. Inorg. Nucl. Chem.	5761	384	– –	6.7	– –	– –	0.96
46. Amer. J. Physiol.	21519	380	– –	1.8	– –	– –	2.41
47. Acta Chem. Scand.	8627	373	– –	4.3	– –	– –	1.03
48. Inorganic Chem.	14310	373	– –	2.6	– –	– –	2.45
49. Liebigs Ann. Chemie	6171	361	– –	5.8	– –	– –	1.02
50. Physics Letters B	9958	359	– –	3.6	– –	– –	3.42

Figure 9.58 Journals cited most frequently by Japanese journals. Those that are Japanese are identified by italicized titles. A = citations from all journals. B = citations from Japanese journals. C = self-citations. D = ratio of citations from Japanese journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from Japanese journals. G = overall impact.

Journal	A	B	C	D	E	F	G
1. *Bull. Chem. Soc. Japan*	12204	1710	1386	14.0	11.4	81.1	0.93
2. *Chem. Pharmaceut. Bull.*	7163	1682	1076	23.5	15.0	64.0	0.93
3. *J. Biochemistry*	9204	1293	874	14.0	9.5	67.6	1.71
4. *Progr. Theoret. Phys.*	7107	1283	1271	18.1	17.9	99.1	1.41
5. *Agric. Biol. Chem.*	6194	1138	796	18.4	12.9	69.9	0.96
6. Biochim. Biophys. Acta.	53872	596	– –	1.1	– –	– –	3.11
7. *Chemistry Letters*	3502	469	145	13.4	4.1	30.9	0.86
8. *Jap. J. Appl. Phys.*	4816	459	400	9.5	8.3	87.1	0.66
9. *J. Antibiotics Tokyo*	2253	418	339	18.6	15.0	87.1	2.04
10. J. Organic Chem.	23962	395	– –	1.6	– –	– –	1.49
11. J. Amer. Chem. Soc.	51763	394	– –	0.8	– –	– –	4.38
12. Analyt. Chem.	27535	388	– –	1.4	– –	– –	3.29
13. *Japan Analyst*	12695	365	– –	2.9	– –	– –	0.07
14. J. Chem. Soc. Perkin	23011	343	– –	1.5	– –	– –	1.35
15. Tetrahedron Letters	12646	332	– –	2.6	– –	– –	1.77
16. *J. Synth. Org. Chem.*	3900	329	– –	8.4	– –	– –	0.17
17. J. Biol. Chemistry	36942	320	– –	0.9	– –	– –	5.84
18. *J. Ferment. Technol.*	1190	303	154	25.5	12.9	50.8	0.36
19. Physical Review B.	34284	299	– –	0.9	– –	– –	2.86
20. Uspekhi Khimii	14839	281	– –	1.9	– –	– –	1.08
21. J. Chem. Soc. Japan	4194	278	– –	6.6	– –	– –	0.20
22. *Plant and Cell Physiol.*	1852	274	212	14.8	11.4	77.4	1.16
23. *J. Pharmaceut. Soc. Japan*	2449	274	5	11.2	0.2	1.8	0.35
24. Phytochemistry	9347	269	– –	2.9	– –	– –	1.10
25. Tetrahedron	16259	269	– –	1.6	– –	– –	1.57
26. Biochem. Biophys. Res. Comm.	15832	244	– –	1.5	– –	– –	3.73
27. Biochemistry	25071	242	– –	1.0	– –	– –	4.71
28. J. Chem. Physics	43528	218	– –	0.5	– –	– –	2.91
29. J. Pharmaceut. Sci.	9986	217	– –	2.2	– –	– –	1.62
30. *Jap. J. Pharmacology*	2204	217	120	9.8	5.4	55.3	0.66
31. *Gann*	1552	212	136	13.7	8.8	64.2	1.00
32. J. Organometal. Chem.	27075	211	– –	0.8	– –	– –	2.38
33. *J. Phys. Earth*	– –	204	– –	– –	– –	– –	– –
34. *Bull. Jap. Soc. Mech. Eng.*	1623	201	195	12.4	12.0	97.0	0.35
35. *Bull. Jap. Soc. Sci. Fish.*	1456	198	– –	13.6	– –	– –	0.22
36. Physical Review D	18660	197	– –	1.1	– –	– –	2.72
37. FEBS Letters	17840	171	– –	1.0	– –	– –	3.05
38. *Tohoku J. Exp. Med.*	1807	166	124	9.2	6.9	74.7	0.46
39. Eur. J. Biochemistry	18447	163	– –	0.9	– –	– –	3.87
40. *Proc. Japan Acad.*	1530	163	108	10.7	7.1	66.3	0.35
41. *Polymer J. Japan*	1389	159	99	11.4	7.1	62.3	1.30
42. *J. Agr. Chem. Soc. Japan*	982	158	– –	16.1	– –	– –	0.29
43. J. Bacteriology	14219	156	– –	1.1	– –	– –	2.72
44. Arch. Biochem. Biophys.	12573	155	– –	1.2	– –	– –	2.95
45. *Jap. J. Exp. Med.*	1331	155	107	11.6	8.0	69.0	0.78
46. Nuclear Physics A	20623	155	– –	0.8	– –	– –	2.42
47. Inorganic Chem.	16965	152	– –	0.9	– –	– –	2.45
48. Biochem. J.	16318	145	– –	0.9	– –	– –	3.62
49. Cancer Research	14284	144	– –	1.0	– –	– –	3.39
50. J. Inorg. Nucl. Chem.	10465	143	– –	1.4	– –	– –	0.96

Figure 9.59 Major sources of references to Japanese journals. Those that are Japanese journals are identified by italicized titles. A = references to all journals. B = references to Japanese journals. C = references to self. D = ratio of Japanese references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to Japanese references. G = overall impact.

German Journal Literature (31)

A study of a core group of German journals showed a literature quite different from those of Japan, France, and Russia. The core group consisted of 288 journals, published in East and West Germany, that were covered by *SCI* in 1974. German-language journals of Austria and Switzerland were not included. The core group accounted for almost 10% of the material in the 1974 *SCI*: 9.3% of the journals covered, 8.2% of the source articles processed, and 9.9% of the references compiled.

The list of journals cited most frequently by the core group (Figure 9.60) is interesting in two respects. One is that when the 16 German journals on this list are removed, the composition and ranking of the list roughly matched an international list of the most frequently cited journals.

The other interesting feature of Figure 9.60 is the German share of the total citation rate (column D) of the journals. Since the German share of the international pool of references was 9.9%, the core group should have accounted for roughly the same percentage of the citation rates of the 50 most cited journals. Except for the German journals on the list, the percentage tended to stay within the range of 6.5 to 9, which is quite close to the statistical ideal. It rarely dropped below 6%. In the case of the 16 German journals on the list, the percentage soared far above the share of the international reference pool, as it did with the Japanese and French literature; but, unlike those literatures, only one of the German journals ranked among the top 12.

More than half of the major sources of citations to the core group (Figure 9.61) came from the group itself. With few exceptions—*Nature, Brain Research, Cell Tissue Research*—all the non-German sources were journals of physics and chemistry. Again, as in the case of the French and Japanese literatures, the core group was cited by the German source journals at a rate that exceeded its share of the international pool of source articles processed. Its share of that pool was roughly 8%, while it accounted for two and three times that percentage of the references published by the German source journals. Its shares of the references published by the non-German source journals, however, rarely reached the 8% level. Nevertheless, on a relative basis, the German literature did better in this respect than either the Japanese or French literature.

APPLICATION SCOPE

This series of studies, which is a continuing one (32–37), clearly demonstrates that journal citation data contains much useful information. The nature and quantity of the information, of course, depends, to an important degree, on the types of questions that are posed. But even answers to the most obvious and basic questions are useful, as demonstrated by the fact that they are now being sought by people in policy-making positions (38–40). Knowing the citation rate of a journal, the sources

Journal	A	B	C	D	E	F	G
1. J. Amer. Chem. Soc. (1)	98995	6357	— —	6.4	— —	— —	4.383
2. J. Biol. Chem. (2)	81354	5979	— —	7.3	— —	— —	5.843
3. Nature (4)	59206	4350	— —	7.3	— —	— —	3.636
4. Biochim. Biophys. Acta (5)	51487	3976	— —	7.7	— —	— —	3.170
5. Physical Review (6)	40815	3580	— —	8.8	— —	— —	— —
6. J. Chem. Physics (3)	62040	3578	— —	5.8	— —	— —	2.918
7. *Angew. Chem. (& Int. Ed.)* (136)	10756	3281	1153	30.5	10.7	35.1	4.140
8. P. Nat. Acad. Sci. USA (8)	46916	3213	— —	6.8	— —	— —	8.989
9. Science (7)	46488	2953	— —	6.4	— —	— —	5.412
10. Lancet (9)	37407	2927	— —	7.9	— —	— —	6.677
11. Biochemical J. (10)	31563	2591	— —	8.2	— —	— —	3.627
12. Astrophysical J. (18)	20543	2530	— —	12.3	— —	— —	4.063
13. *Deut. Med. Wschr.* (192)	3878	2480	661	64.0	17.0	26.7	1.017
14. *Chem. Berichte* (44)	9569	2447	1208	25.6	12.6	49.4	1.493
15. J. Molecular Biol. (15)	24209	2120	— —	8.8	— —	— —	7.502
16. *Eur. J. Biochemistry* (49)	11367	2079	1404	18.3	12.4	67.5	3.874
17. J. Clin. Invest. (14)	24768	1930	— —	7.8	— —	— —	6.992
18. New Engl. J. Med. (13)	26726	1854	— —	6.9	— —	— —	8.364
19. *Arzneimittelforschung* (217)	3534	1819	835	51.5	23.6	45.9	0.876
20. Biochemistry (12)	27080	1762	— —	6.5	— —	— —	4.711
21. Amer. J. Physiol. (19)	21519	1735	— —	8.1	— —	— —	2.414
22. Bioch. Biophys. Res. Co. (16)	23136	1689	— —	7.3	— —	— —	3.744
23. J. Physiology (17)	18435	1682	— —	9.1	— —	— —	4.495
24. J. Cell Biology (25)	19103	1615	— —	8.5	— —	— —	6.770
25. J. Organic Chem. (22)	20539	1576	— —	7.7	— —	— —	1.495
26. *Klin. Wschr.* (235)	3301	1570	216	47.6	6.5	13.8	1.033
27. Brit. Med. J. (20)	20700	1560	— —	7.5	— —	— —	3.556
28. J. Chemical Society (23)	14604	1464	— —	10.0	— —	— —	— —
29. Tetrahedron Letters (31)	16478	1464	— —	8.9	— —	— —	1.777
30. J. Amer. Med. Assoc. (30)	17211	1410	— —	8.2	— —	— —	3.068
31. P. Soc. Exp. Biol. Med. (28)	18167	1387	— —	7.6	— —	— —	1.471
32. *Zschr. Anorg. Allg. Chem.* (145)	4698	1371	806	29.2	17.2	58.8	1.019
33. J. Pharmacol. Exp. Ther. (42)	13753	1304	— —	9.5	— —	— —	3.576
34. Physical Review B (57)	16104	1281	— —	8.0	— —	— —	2.864
35. *Zschr. Physik* (98)	6662	1233	653	18.5	9.8	53.0	1.340
36. J. Appl. Physics (24)	19277	1232	— —	6.4	— —	— —	1.558
37. J. Bacteriology (26)	18369	1223	— —	6.7	— —	— —	2.727
38. *Pflugers Arch./ Eur. J. Physiol* (172)	4196	1217	597	29.0	14.2	49.1	1.810
39. *Hoppe-Seyler Zschr. Physiol. Chem.* (150)	3586	1198	504	33.4	14.1	42.1	2.291
40. *Astronomy Astrophysics* (190)	3638	1157	1133	31.8	31.1	97.9	2.267
41. Arch. Biochem. Biophys. (36)	15072	1123	— —	7.5	— —	— —	2.881
42. Physical Rev. Letters (11)	29229	1104	— —	3.8	— —	— —	5.059
43. Circulation (38)	14461	1089	— —	7.5	— —	— —	6.834
44. Annals New York Acad. Sci. (37)	14648	1084	— —	7.4	— —	— —	1.181
45. *Naunyn-Schmiedeberg* (291)	2685	1076	534	40.1	19.9	49.6	2.792
46. *Z. Naturforschung A* (183)	4034	1069	557	26.5	13.8	52.1	1.121
47. *Fschr. Geb. Roentgenf.* (495)	1452	1064	540	73.3	37.2	50.8	0.384
48. FEBS Letters (64)	9094	1059	— —	11.6	— —	— —	3.049
49. J. Exp. Med. (21)	20699	1051	— —	5.1	— —	— —	11.874
50. *Planta* (170)	4308	1049	591	24.4	13.7	56.3	2.589

Figure 9.60 Journals cited most frequently by German journals. Those that are German are identified by italicized titles. A = citations from all journals. B = citations from German journals. C = self-citations. D = ratio of citations from German journals to citations from all journals. E = ratio of self-citations to citations from all journals (self-cited rate). F = ratio of self-citations to citations from German journals. G = overall impact.Figures in parentheses following the names of the journals show their ranks on ISI's international list of most highly cited journals.

	Journal	A	B	C	D	E	F	G
1.	***Chemische Berichte***	9220	2572	1208	27.9	13.1	47.0	1.493
2.	J. Amer. Chem. Soc.	51763	2063	– –	4.0	– –	– –	4.383
3.	***Eur. J. Biochemistry***	18447	1934	1404	10.5	7.6	72.6	3.874
4.	***Deut. Med. Wschr.***	13507	1813	661	13.4	4.9	36.5	1.017
5.	J. Organomet. Chem.	27075	1773	– –	6.5	–	– –	2.392
6.	Bioch. Biophy. Acta	53872	1744	– –	3.2	– –	– –	3.170
7.	***Angew. Chem. (& Int. Ed.)***	8157	1713	1153	21.0	14.1	67.3	4.140
8.	***Arzneimittelforschung***	9869	1654	835	16.8	8.5	50.5	0.876
9.	Cell Tissue Res.	8759	1550	– –	17.7	– –	– –	– –
10.	***Zschr. Anorg. Allg. Chem.***	4975	1411	806	28.4	16.2	57.1	1.014
11.	J. Organic Chem.	23962	1269	– –	5.3	– –	– –	1.495
12.	***Astronomy Astrophysics***	8907	1157	1133	13.0	12.7	97.9	2.267
13.	Brain Res.	23135	1149	– –	5.0	– –	– –	3.104
14.	***Phys. Stat. Sol. A***	10851	1014	589	9.3	5.4	58.1	0.935
15.	J. Chem. Physics	43528	1005	– –	2.3	– –	– –	2.918
16.	***Phys. Stat. Sol. B.***	11896	999	610	8.4	5.1	61.1	1.113
17.	Analytical Chemistry	27535	985	– –	3.6	– –	– –	3.291
18.	***Zschr. Naturforschung A***	6408	974	– –	15.2	8.7	57.2	1.121
19.	FEBS Letters	17840	973	– –	5.5	– –	– –	3.049
20.	J. Biol. Chemistry	36942	954		2.6	– –	– –	5.843
21.	Tetrahedron Letters	12646	953	– –	7.5	– –	– –	1.777
22.	***Hoppe-Seyler Zschr. Physiol. Chem.***	5469	938	504	17.2	9.2	53.7	2.291
23.	Astrophysical J.	21445	923	– –	4.3	– –	– –	4.063
24.	***Naunyn-Schmiedeberg***	4635	890	534	19.2	11.5	60.0	2.792
25.	Biochemistry	25071	829	– –	3.3	– –	– –	4.711
26.	***Makromolek. Chemie***	5507	837	628	15.2	11.4	75.0	1.088
27.	Tetrahedron	16259	831	– –	5.1	– –	– –	1.576
28.	***Psychopharmacologia***	5430	823	673	15.2	12.4	81.8	2.347
29.	***J. Liebigs Ann. Chemie***	3616	815	– –	22.5	– –	– –	1.024
30.	***Fschr. Geb. Roentgenf.***	3840	800	450	20.8	11.7	56.3	0.384
31.	***Pharmazie***	5841	800	285	13.7	4.9	35.6	0.675
32.	J. Chem. Soc. Perkin	23011	782	– –	3.4	– –	– –	1.348
33.	***Klin. Mbl. Augenheilk.***	3686	780	669	21.2	18.1	85.8	0.631
34.	***Zschr. Chemie***	3905	772	264	19.8	6.8	34.2	0.178
35.	***Zschr. Physik***	7150	769	653	10.8	9.1	84.9	1.340
36.	***Planta***	4326	768	591	17.8	13.7	77.0	2.588
37.	Physical Review B	34284	766	– –	2.2	– –	– –	2.864
38.	***Pflugers Arch./Eur. J. Physiol.***	5365	755	597	14.1	11.1	79.1	1.810
39.	***Chromosoma***	3426	739	642	21.6	18.7	86.9	3.875
40.	***Acta Biol. Med. Germ.***	3862	731	301	18.9	7.8	41.2	0.678
41.	Uspekhi Khimii	14839	721	– –	4.9	– –	– –	1.079
42.	Nature	30125	718	– –	2.4	– –	– –	3.636
43.	***Klin. Wschr.***	6179	697	216	11.3	3.5	31.0	1.033
44.	Proc. Nat. Acad. Sci. US	28352	697	– –	2.4	– –	– –	8.989
45.	***Ber. Bunsenges. Phys. Chem.***	5425	695	318	12.8	5.9	45.8	1.382
46.	***Zschr. Naturforschung B***	4618	676	171	14.6	3.7	25.3	1.032
47.	Biochemical J.	16318	665	– –	4.1	– –	– –	3.627
48.	Bioch. Bioph. Res. Comm.	15832	659	– –	4.2	– –	– –	3.744
49.	***Molec. General Genetics***	5156	650	516	12.6	10.0	79.4	2.699
50.	***Humangenetik***	4313	618	373	14.3	8.6	60.4	1.703

Figure 9.61 Major sources of references to German journals. Those that are German journals are identified by italicized titles. A = references to all journals. B = references to German journals. C = references to self. D = ratio of German references to all references. E = ratio of self-citations to all references (self-citing rate). F = ratio of self-citations to German references. G = overall impact.

of the references that cite it, and the journals it cites makes it possible to measure its utility as a source of research information, characterize its editorial orientation with a high degree of subtlety, and, depending upon the journal, define the core literature of a specialty or discipline. When these same questions are asked about a core literature, the answers provide insights into the research performance, orientation, and relationships of the discipline, specialty, or nation represented by the literature. And all these characteristics can be quantified well enough to make valid comparisons: time periods can be compared to detect significant changes, journals can be compared to determine relative merits, and core literatures can be compared to define in more detail the nature of the relationships between different research communities.

There is, however, even more useful information to be extracted from journal citation data. The extraction will require a more sophisticated set of questions from those who are concerned with the history, sociology, evaluation, and planning of science. These questions are just starting to be formulated, but I think that they will soon come flying thick and fast. By making the answers to the simpler questions more accessible, *JCR* should stimulate the formulation of the more sophisticated ones. The selected bibliography at the end of this chapter provides some idea of how far we had come in this application of journal citation data by the time the first formal edition of *JCR* was published in 1975. I think the studies it identifies represent only the beginning of what will be done with journal citation data to increase both our understanding of how science works and our ability to make it work better.

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