

Scientometric highlights on science and technology related review articles affiliated to India

Anil Sagar^{1*}, V. L. Kalyane¹, E. R. Prakasan¹, R. G. Garg², Vijai Kumar¹

¹Scientific Information Resource Division, Knowledge Management Group,
Bhabha Atomic Research Centre, Maharashtra, Mumbai 400 085, INDIA

² School of Studies in Library and Information Science, Jiwaji University,
Madhya Pradesh, Gwalior 474 011, INDIA
e-mail: anilsagarbarc@yahoo.com

ABSTRACT

Review Articles are of primary importance as a scholarly output and have become a secondary source in order to access older primary literature. The present study is a quantitative documentation of 'Review Articles' published during 2000-2005 in the Science Citation Index (SCI) and having India in the affiliation of authors. SCI considers article having 100 or more synchronous references as 'review'. Records with 'Review' in Document type field are extracted out from the results of the search 'India' in the 'Address word' field for the indicated publication period, which resulted in a total of 2042 records by 5135 individual authors in over 640 individual journals. Authors from Bhabha Atomic Research Centre, Mumbai, India are in the forefront among the most productive review writers. Findings indicated that the average yearly growth rate is 11.04, and that 85.16 per cent of the total Review Articles are written in collaboration. Of these collaborative works, 22.9 percent are written with authors from 78 different countries. The study clearly shows that collaboration of Indian reviewers with people from outside India is significant. Multidisciplinary Sciences; Chemistry in General; General and Internal Medicine; Biochemistry and Molecular Biology; and Pharmacology and Pharmacy are the main fields in which majority of the Review Articles are written. The inter-quartile mean of the number of Synchronous References of the 2042 Review Articles is found as 94.84.

Keywords: Review articles; Scientometrics; Publication productivity; Bibliometrics; Informetrics.

INTRODUCTION

Review Articles synthesize and evaluate recent progress in an area. Good Review Articles are explicit accounts of what the vast majority of experienced scientists in a field consider to be the acceptable facts and the significant relationships among these facts. Comprehensive Review Articles precisely identify, but do not necessarily exclude, that which is still regarded as speculation and may provide other experienced researchers in the field with strong indications of what is ripe for scientific inquiry. Review Articles are an essential part of the continuous reassessment of the current stage of scientific knowledge in a field, and such reassessment is not simply a matter of retrieving and synthesizing piecemeal, discrete facts (Vickery and Vickery 2004).

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A complete and concise Review Article of an area can be of great help to a researcher new to that field. Review Articles in a particular area help in bypassing the compilation of bulk bibliographies in that field, and therefore saves the time of the researcher. In this regard, Garfield (1994) stated that Review Articles often serve as surrogates for earlier literature, thus avoiding extensive bibliographies. A good Review Article should present the controversial data, and perhaps that will stimulate ideas for other experiments to resolve the controversy (Jerrells 2000). Given the increasing volume of literature and the limited time for reading that, busy researchers have, reliance on Review Articles is likely to increase, and even though concerns have been raised that narrative and nonsystematic Review Articles may produce biased conclusions (McAlister et al. 1999). Systematic Review Articles are cited more often than narrative Review Articles, an indirect endorsement of the 'hierarchy of evidence' (Montori 2003). Review Articles constitute a form of original research, albeit done in the library rather than in the laboratory (Squires 1989). Review Articles are of primary importance as a scholarly output. Review Articles also become a secondary source in order to access older primary literature. The author(s) of Review Articles provides a major service by agreeing to carry out a more or less comprehensive literature search from some particular self-selected vantage point. A good Review Article accomplishes much more than merely collecting facts otherwise widely dispersed across a host of primary sources. The principal objective is to establish some degree of order among the facts. To the extent that this entails passing judgments, the reviewer(s) actually becomes something of a "trend setter" with respect to future research. In an age suffering under increasing fragmentation of knowledge, Review Articles assume its important role. Thus, Review Articles present information drawn from a large number of (selected) original papers, organized and analyzed for the purpose of educating the reader regarding the current status of some narrow field of specialization.

Review Articles are viewed as a transitional phase between primary research literature on one hand and books on the other. Editor(s) of serials solicit commissioned Review Articles. Hence, an invitation to write a Review Article should be cherished as compelling evidence that one's expertise has been recognized (Ebel, Bliefert and Russy 2004) for higher-level of publication. Editors play an especially important role in the enforcement of standards governing communication, with indispensable support from a host of dedicated and conscientious Review Articles. Modern science and technology is heavily dependent upon the notion that reported results will always be verifiable. Publications in reputable serials implies that reported findings and observations are capable of surviving in every way the potential test of replication by one's peers within the discipline.

The present study attempts to conduct a quantitative documentation of 'Review Articles' published during 2000-2005 and having India in the affiliation of authors. The target of the present study are journal editors of science publications, publication policy makers, quality controllers of research and development (R & D), scientometricians, documentalists, knowledge managers, information scientists and historians of science.

METHODS

Science Citation Index (SCI) © CD-ROM version is serviced by the Institute for Scientific Information (ISI), Philadelphia (now a division of the Thomson Corporation). Any article having 100 or more synchronous references are considered as 'review' by *SCI*, besides all articles categorised as 'review article' by the sources/channels of communications. Records with 'Review' in Document type field are extracted out from the results of the search 'India' in the 'Address word' field for the publication period from 2000-2005.

Numerical 'Impact Factors (IF)' and 'Immediacy Index (II)', are revised annually and published as *Journal Citation Reports (JCR)-2004*, a companion volume to *SCI* (Garfield 1972), was consulted as per requirement of documentation. The classification of the journals given in *Journal Citation Reports (JCR)-2004*, is made use of for the broad classification of the Review Articles. The well-known bibliometric/informetric/scientometric methods are followed consistently in this study. The term Synchronous References refers to the references at the end of each and every Review Articles under study.

RESULTS AND DISCUSSION

The search resulted in a total of 2042 records and these records are analysed as per the objective of the study. The results and discussions based on these are briefly explained as follows:

Chronological Growth of Review Articles

The publication years of the 2042 records are analysed and the results are presented graphically in Figure 1. It has observed a nominal growth in number of published Review Articles during the 2000-2005 as per *Science Citation Index*. The average yearly growth rate has also been calculated from the data and found to be 11.04.

Authorship Pattern and Author Productivity

The extent of collaboration in writing Review Articles is analysed and it has been found that 85.16 per cent of the total Review Articles are written in collaboration. Among these collaborated Review Articles, collaboration of two, three and four authors constitute more than 70 per cent. Table 1 shows year-wise collaboration pattern observed in the Review Articles taken into consideration. On the extreme end, 255 different authors have collaborated for writing a Review Article.

The 2042 Review Articles under study is the collective work of 5135 individual authors and the study has identified those authors. The top thirty authors with their latest affiliation and the number of internationally collaborated Review Articles are given in Table 2. Authors from Bhabha Atomic Research Centre, Mumbai, India are in the forefront among the most productive review writers.

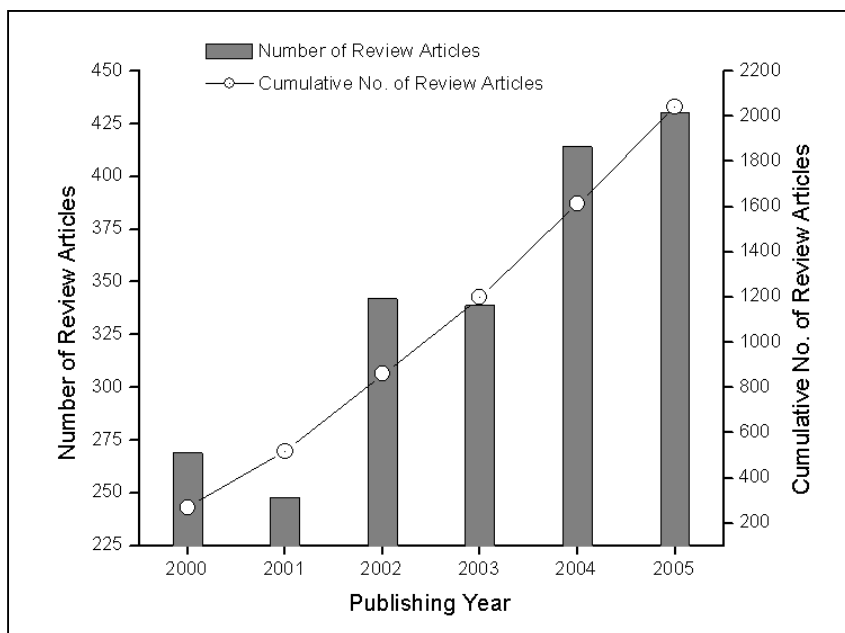


Figure 1: Chronological Growth in Number of Published Review Articles in *Science Citation Index* (2000-2005)

Table 1: Publication Year-Wise Number of Authorships Observed in the Review Articles in *Science Citation Index* (2000-2005)

Number of author(s)	Publications Year						2000-2005		
	2000	2001	2002	2003	2004	2005	Total Review	Percentage	Cumulative Percentage
1	34	40	51	55	68	55	303	14.84	14.84
2	105	85	122	98	128	141	679	33.25	48.09
3	68	67	83	86	113	103	520	25.47	73.56
4	35	28	44	40	60	55	262	12.83	86.39
5	15	12	11	31	17	32	118	5.78	92.16
6	8	7	15	13	10	18	71	3.48	95.64
7		2	2	2	9	8	23	1.13	96.77
8	2	2	5	2	1	4	16	0.78	97.55
9		2	5	3	2	3	15	0.73	98.29
10				1		4	5	0.24	98.53
11		1				1	2	0.10	98.63
12					1	1	2	0.10	98.73
13				1		1	2	0.10	98.82
15		1	1			1	3	0.15	98.97
16		1		1			2	0.10	99.07
17				2	1		3	0.15	99.22
18			1				1	0.05	99.27

Table continued on next page

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19				1			1	0.05	99.31
22					1		1	0.05	99.36
23	1						1	0.05	99.41
25				1	1	1	3	0.15	99.56
26				1	1		2	0.10	99.66
32				1			1	0.05	99.71
36			1				1	0.05	99.76
53					1		1	0.05	99.80
140			1				1	0.05	99.85
166						1	1	0.05	99.90
225						1	1	0.05	99.95
255	1						1	0.05	100.00
Total no. of collaborated Review Articles	235	208	291	284	346	375	235	85.16	-
Total no. of Review Articles	269	248	342	339	414	430	2042	100.00	-

Table 2: Top 30 Authors in Descending Order of Authorship Credits Observed in the Review Articles in *Science Citation Index* (2000-2005)

Rank	Author	Affiliation	Number of authorship credits	ICR*
1	Mukherjee-T	Bhabha Atomic Research Centre-Mumbai	20	2
2	Mohan-H	Bhabha Atomic Research Centre-Mumbai	10	0
3	Kishore-K	Bhabha Atomic Research Centre-Mumbai	9	0
3	Kapoor-S	Bhabha Atomic Research Centre-Mumbai	9	1
3	Rao-CNR	Indian Institute of Science-Bangalore	9	4
3	Padmanabhan-T	Inter Univ Ctr for Astron & Astrophys-Pune	9	2
3	Banerjee-UC	Natl-Inst-Pharmaceut-Educ-&-Res-Mohali	9	3
3	Sinha-VR	Punjab University-Chandigarh	9	0
3	Sehgal-VN	Sehgal Nursing Home-New Delhi	9	0
4	Naik-DB	Bhabha Atomic Research Centre-Mumbai	8	1
4	Nair-V	CSIR, Reg Res Lab-Trivandrum	8	0
4	Jain-RK	Inst Microbial Technol-Chandigarh	8	1
4	Tuteja-N	Int Ctr Genet Engn & Biotechnol-New Delhi	8	1
4	Mohan-V	Madras Diabet Res Fdn-Chennai	8	1
4	Garg-S	Natl-Inst-Pharmaceut-Educ-&-Res-Mohali	8	1
4	Panchagnula-R	Natl-Inst-Pharmaceut-Educ-&-Res-Mohali	8	0
5	Dey-GR	Bhabha Atomic Research Centre-Mumbai	7	0
5	Ravishankar-GA	Cent Food Technol Res Inst-Mysore	7	1
5	Surolia-N	Indian Institute of Science-Bangalore	7	2
5	Tuteja-R	Int Ctr Genet Engn & Biotechnol-New Delhi	7	1
5	Ahmad-S	Jamia Millia Islamia-New Delhi	7	0
5	Singla-AK	Punjab University-Chandigarh	7	1
5	Gupta-R	University of Delhi-New Delhi	7	2

*ICR = No. of internationally collaborated Review Articles

Author Affiliations and Collaborations

The affiliations of the authors, who wrote the 2042 Review Articles are segregated and the most occurred affiliations (occurred more than 25 times) are listed in Table 3 with the number of times occurred. The Indian Institute of Science, Bangalore; All India Institute of Medical Sciences, New Delhi; Bhabha Atomic Research Centre, Mumbai; Indian Institute of Technology, New Delhi; and Delhi University, New Delhi are the top five most occurred author affiliations. When the collaborated Review Articles of these 22 affiliations are considered, on an average 22.9 percentage are written in collaboration with authors from outside India.

The countries in the affiliation of authors of the internationally collaborated Review Articles are analysed and the results of the top ten countries other than India are presented in Table 4. It has been observed that Indian authors collaborated with authors from 78 different countries. USA has a comparatively good number of Review Articles with Indian authors followed by Germany, Japan, England and France.

Table 3: Affiliation of Authors (occurred more than 25 times) who Wrote Review Articles in *Science Citation Index* (2000-2005)

Rank	Affiliation	TA	TR	% of TR	ICR	% of ICR
1	Indian Inst Sci-Bangalore	116	102	5.00	17	16.67
2	All India Inst Med Sci-New Delhi	98	84	4.11	10	11.90
3	Bhabha Atomic Research Centre-Mumbai	82	76	3.72	14	18.42
4	Indian Inst Technol-New Delhi	68	59	2.89	11	18.64
5	Delhi Univ-New Delhi	60	56	2.74	18	32.14
6	Panjab Univ-Patiala	54	49	2.40	7	14.29
7	Tata Inst Fundamental Res-Mumbai	48	47	2.30	22	46.81
8	Indian Inst Technol-Mumbai	49	44	2.15	17	38.64
9	Natl Inst Pharmaceut Educ & Res-Mohali	45	43	2.11	7	16.28
10	Banaras Hindu Univ-Varanasi	40	38	1.86	10	26.32
11	Postgrad Inst Med Educ & Res-Chandigarh	47	36	1.76	3	8.33
12	Indian Inst Chem Technol-Hyderabad	36	34	1.67	4	11.76
13	Jawaharlal Nehru Ctr Adv Sci Res-Bangalore	41	33	1.62	5	15.15
14	Cent Food Technol Res Inst-Mysore	34	33	1.62	9	27.27
15	Indian Inst Technol-Kanpur	33	33	1.62	13	39.39
15	CSIR-Reg Res Lab -Trivandrum	33	33	1.62	7	21.21
16	Natl Chem Lab-Pune	32	32	1.57	7	21.88
17	Indian Inst Technol-Kharagpur	28	28	1.37	6	21.43
18	Univ Hyderabad-Hyderabad	27	26	1.27	5	19.23
19	Sanjay Gandhi Postgrad Inst Med Sci-Lucknow	32	24	1.18	7	29.17
20	Jadavpur Univ-Kolkata	26	24	1.18	6	25.00
20	Christian Med Coll & Hosp-Vellore	26	21	1.03	5	23.81

(TA = No. of times occurred; TR = Total number of Reviews; and ICR = No. of collaborated Review Articles)

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Table 4: Countries other than India in the Affiliation of the Collaborated Review Articles in *Science Citation Index* (2000-2005)

Country	Publication Year-wise Number of Review(s) and Affiliations												Total	
	2000		2001		2002		2003		2004		2005			
	R*	A*	R	A	R	A	R	A	R	A	R	A	R	A
USA	20	32	19	27	32	96	42	124	38	97	44	112	195	488
GERMANY	12	16	10	11	8	13	12	21	14	27	23	31	79	119
JAPAN	6	8	3	3	5	9	11	24	14	21	5	16	44	81
ENGLAND	9	11	2	3	5	14	4	10	12	16	9	10	41	64
FRANCE	7	15	4	6	2	2	9	18	3	6	9	17	34	64
CANADA	3	3	2	2	3	5	9	14	4	6	11	16	32	46
PEOPLES-R-CHINA	2	3	1	1	2	2	7	8	9	14	6	9	27	37
ITALY	3	19	3	3	7	16	2	8	6	26	3	3	24	75
AUSTRALIA	2	2	3	3	4	5	4	8	4	5	4	5	21	28
NETHERLANDS	2	7	2	2	5	6	5	7	5	9	2	4	21	35

(truncated)

*(R = Number of Review Articles; and A = Number of Affiliations)

Table 5 lists the most occurred (more than six times) affiliations of authors from countries other than India who collaborated with Indian Review writers. Even though USA has appeared at the top among the countries of affiliations of the internationally collaborated Review Articles, IST-NAZL-FIS-NUCL, Italy and CERN, Switzerland are on the top of the affiliations to which Indian Review writers are most associated with.

Table 5: Most Occurred (more than six times) Affiliations of Authors, who Wrote Review Articles with Indian Authors in *Science Citation Index* (2000-2005)

Affiliation	No. of occurrence
IST-NAZL-FIS-NUCL-ITALY	24
CERN-SWITZERLAND	12
UNIV-CALIF-BERKELEY-USA	12
UNIV-TEXAS-USA	11
COLUMBIA-UNIV-USA	9
UNIV-CALIF-RIVERSIDE-USA	9
NORTHEASTERN-UNIV-USA	8
UNIV-TOKYO-JAPAN	8
CALTECH-USA	7
HEBREW-UNIV-JERUSALEM-ISRAEL	7
LUND-UNIV-SWEDEN	7
MICHIGAN-STATE-UNIV-USA	7
MIT-USA	7
PRINCETON-UNIV-USA	7
TEXAS-A&M-UNIV-USA	7
TOHOKU-UNIV-JAPAN	7
UNIV-BIRMINGHAM-ENGLAND	7
BROOKHAVEN-NATL-LAB-USA	6
CTR-DIS-CONTROL-&-PREVENT-USA	6
DESY-GERMANY	6

Published Journals

The 2042 Review Articles considered for the present study are published over 640 individual journals. A truncated list (those journals which have occurred more than ten or more than ten times) is given in Table 6. Current Science; Research on Chemical Intermediates; Indian Journal of Medical Research; National Medical Journal of India; Progress in Organic Coatings are the leading journals which publish Review Articles of Indian origin.

The 640 journals, which have published Review Articles affiliated to India, are published from 27 countries as listed in Table 7. Among them, USA publishes 36.41 percentage of journals followed by England (25.63 %); Netherlands (15.16 %); Germany (6.72 %); Switzerland (2.34%) etc. The Impact Factors of the journals are analysed and the trend is shown in Figure 2.

Table 6: Most Occurred Journals in which Review Articles in Science Citation Index (2000-2005) are Published with their Impact Factors (IF-2004)

Rank	Serial Publication	Country	Review Articles	%	IF-2004
1	CURRENT SCIENCE	India	201	9.84	0.688
2	RESEARCH ON CHEMICAL INTERMEDIATES	The Netherlands	69	3.38	0.446
3	INDIAN JOURNAL OF MEDICAL RESEARCH	India	59	2.89	0.600
4	NATIONAL MEDICAL JOURNAL OF INDIA	India	36	1.76	0.626
5	PROGRESS IN ORGANIC COATINGS	Switzerland	34	1.67	1.214
6	PROG IN CRYSTAL GROW AND CHARACT OF MAT	England	26	1.27	0.531
7	APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	USA	25	1.22	2.358
8	JOURNAL OF MACROMOLECULAR SCIENCE-POLY REV	USA	24	1.18	0.609
9	CHEMICAL REVIEWS	USA	21	1.03	20.233
9	CURRENT MEDICINAL CHEMISTRY	The Netherlands	21	1.03	4.382
10	ACCOUNTS OF CHEMICAL RESEARCH	USA	20	0.98	13.154
11	BIOTECHNOLOGY ADVANCES	England	18	0.88	2.468
12	CRITICAL REVIEWS IN BIOTECHNOLOGY	USA	17	0.83	3.227
12	PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LET	The Netherlands	17	0.83	14.742
12	POSTGRADUATE MEDICAL JOURNAL	England	17	0.83	0.807
13	JOURNAL OF GASTROENTEROLOGY AND HEPATOLOGY	Australia	16	0.78	1.796
13	PHYSICAL REVIEW D	USA	16	0.78	5.156
13	TETRAHEDRON	England	16	0.78	2.643
14	COORDINATION CHEMISTRY REVIEWS	The Netherlands	15	0.73	6.446
14	RENEWABLE & SUSTAINABLE ENERGY REVIEWS	USA	15	0.73	1.614
15	INTERNATIONAL JOURNAL OF DERMATOLOGY	USA	14	0.69	0.884
15	JOURNAL OF BIOSCIENCES	India	14	0.69	1.102
16	PROGRESS IN POLYMER SCIENCE	USA	13	0.64	8.482
17	SURVEY OF OPHTHALMOLOGY	USA	12	0.59	3.221
18	METHODS IN ENZYMOLOGY	USA	11	0.54	1.392
19	ADVANCES IN AGRONOMY	USA	10	0.49	3.212
19	BRITISH MEDICAL JOURNAL	England	10	0.49	7.038
19	CRITICAL REVIEWS IN BIOCHEMISTRY AND MOL BIO	USA	10	0.49	6.115
19	CRITICAL REVIEWS IN PLANT SCIENCES	USA	10	0.49	3.525
19	HETEROCYCLES	Japan	10	0.49	1.064
19	PHARMAZIE	Germany	10	0.49	0.587

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Table 7: Countries of the Journals Publishing Indian Review Articles in
Science Citation Index (2000-2005)

Publishing countries	No. of Journals	% of Total	No. of Review Articles	% of Total	Average Impact Factor (2004)
USA	233	36.41	657	32.17	3.17
England	164	25.63	403	19.74	2.85
Netherlands	97	15.16	323	15.82	2.60
Germany	43	6.72	87	4.26	2.41
Switzerland	15	2.34	55	2.69	1.74
Japan	11	1.72	26	1.27	1.36
Australia	9	1.41	24	1.18	1.07
Denmark	9	1.41	10	0.49	2.79
India	9	1.41	332	16.26	0.60
France	7	1.09	20	0.98	2.15
Singapore	7	1.09	31	1.52	1.01
Ireland	5	0.78	19	0.93	1.77
Scotland	4	0.63	4	0.20	1.19
Austria	3	0.47	4	0.20	1.24
Canada	3	0.47	3	0.15	0.74
Czech Republic	3	0.47	8	0.39	0.54
Italy	3	0.47	8	0.39	3.32
Peoples R China	3	0.47	6	0.29	0.79
New Zealand	2	0.31	2	0.10	4.28
Russia	2	0.31	2	0.10	0.61
South Korea	2	0.31	2	0.10	1.62
Hungary	1	0.16	1	0.05	0.46
Israel	1	0.16	1	0.05	0.68
Norway	1	0.16	2	0.10	1.88
Spain	1	0.16	9	0.44	0.61
Sweden	1	0.16	2	0.10	1.18
Taiwan	1	0.16	1	0.05	1.57
Total	640	100.00	2042	100.00	

The 2042 Review Articles are broadly classified as presented in Table 8 and correlated with the Impact Factors (2004) of the journals in which they are published in. One third of the Review Articles are published in journals having Impact Factors ranges between zero to one. When the Review Articles of Multidisciplinary and Agricultural nature are considered, the majority of them are published in journals having less impact factors.

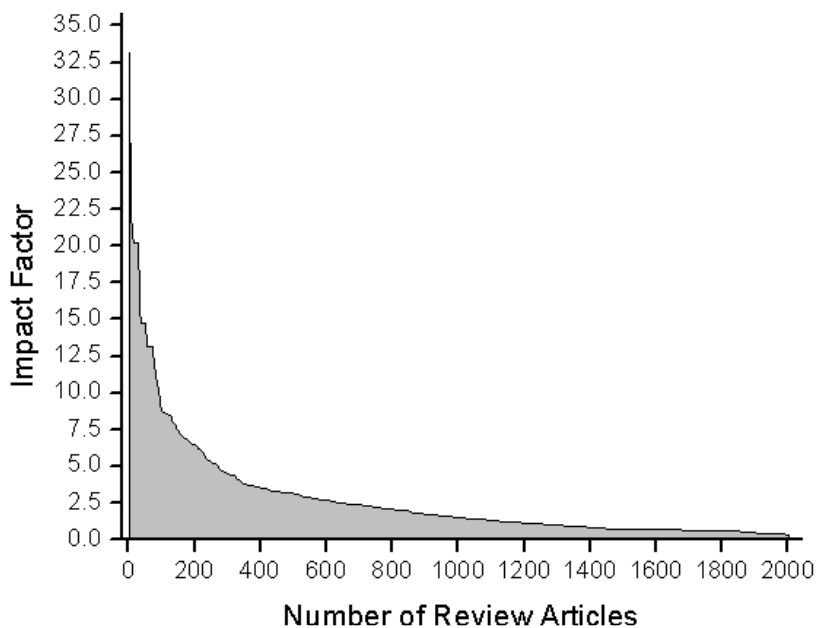


Figure 2: Impact factors of the Journals Publishing Indian Review Articles in *Science Citation Index* (2000-2005)

Table 8: Broad Subject-Wise Categorization and the Impact Factors of the Journals Publishing the Review Articles in *Science Citation Index* (2000-2005)

Subjects	Impact Factor(2004) range											
	0 - 1	>1 - 2	>2 - 3	>3 - 4	>4 - 5	>5 - 6	>6 - 7	>7 - 8	>8 - 9	>9 - 10	>10	0-33.17
Chemical Sciences	193	101	88	48	29	8	22	6	20	4	51	570
Medical Sciences	198	131	91	39	8	12	8	16	3	1	10	517
Biological Sciences	67	108	100	54	26	8	14	4	16	0	5	402
Physical Sciences	52	74	25	19	2	20	13	3	0	0	24	232
Multidisciplinary Sciences	203	10	5	0	0	0	0	0	0	0	0	218
Agricultural Sciences	28	40	7	24	1	0	0	0	0	0	3	103
No. of Review Articles	741	464	316	184	66	48	57	29	39	5	93	2042
Percentage of total	36.29	22.72	15.48	9.01	3.23	2.35	2.79	1.42	1.91	0.24	4.55	100.00

Subject Contents

The Review Articles under consideration are classified as per the subject contents and presented in Table 9. Review Articles of Multidisciplinary Sciences; Chemistry in General; General and Internal Medicine; Biochemistry and Molecular Biology; and Pharmacology & Pharmacy come on top of the list.

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Table 9: Subject Category of the Review Articles in *Science Citation Index* (2000-2005)

Subject	No. of Review Articles	Subject	No. of Review Articles
Multidisciplinary Sciences	209	Marine & Freshwater Biology	7
Chemistry, Multidisciplinary	179	Physics, Applied	7
Medicine, General & Internal	139	Urology & Nephrology	7
Biochemistry & Molecular Biology	108	Biophysics	6
Pharmacology & Pharmacy	99	Dentistry, Oral Surgery & Medicine	6
Biotechnology & Applied Microbiology	92	Electrochemistry	6
Chemistry, Organic	75	Endocrinology & Metabolism	6
Polymer Science	62	Instruments & Instrumentation	6
Plant Sciences	55	Medicine, Research & Experimental	6
Chemistry, Physical	46	Nutrition & Dietetics	6
Chemistry, Applied	39	Agriculture, Soil Science	5
Microbiology	39	Geochemistry & Geophysics	5
Chemistry, Inorganic & Nuclear	37	Geology	5
Environmental Sciences	35	Hematology	5
Materials Science, Multidisciplinary	34	Virology	5
Physics, Multidisciplinary	32	Agriculture, Multidisciplinary	4
Cell Biology	31	Crystallography	4
Food Science & Technology	30	Infectious Disease	4
Astronomy & Astrophysics	27	Mechanics	4
Materials Science, Characterization	26	Obstetrics & Gynecology	4
Chemistry, Medicinal	25	Parasitology	4
Energy & Fuels	25	Psychiatry	4
Gastroenterology & Hepatology	25	Veterinary Sciences	4
Physics, Particles & Fields	25	Agriculture, Dairy & Animal Science	3
Agronomy	23	Ecology	3
Biology	22	Engineering, Aerospace	3
Engineering, Chemical	22	Engineering, Biomedical	3
Geosciences, Multidisciplinary	21	Engineering, Mechanical	3
Dermatology	20	Entomology	3
Ophthalmology	20	Horticulture	3
Chemistry, Analytical	18	Medical Laboratory Technology	3
Neurosciences	17	Optics	3
Genetics & Heredity	16	Paleontology	3
Radiology, Nuclear Medicine & Medical	14	Transplantation	3
Physics, Condensed Matter	13	Geography, Physical	2
Oncology	12	Materials Science, Ceramics	2
Physics, Mathematical	12	Metallurgy & Metallurgical Engineering	2
Cardiac & Cardiovascular Systems	11	Microscopy	2
Clinical, Neurology	11	Mineralogy	2
Engineering, Electrical & Electronics	11	Mining & Mineral Processing	2
Physics, Nuclear	11	Mycology	2
Computer Science	10	Nuclear Science & Technology	2
Pediatrics	10	Spectroscopy	2
Agricultural Engineering	9	Water Resources	2
Biochemical Research Methods	9	Emergency Medicine	1
Developmental biology	8	Operations Research & Management	1
Immunology	8	Orthopedics	1
Physics, Atomic, Molecular & Chemical	8	Otorhinolaryngology	1
Public, Environmental & Occupational	8	Peripheral Vascular Disease	1
Surgery	8	Reproductive Biology	1
Toxicology	8	Respiratory System	1
Anesthesiology	7	Thermodynamics	1

The study has also analysed the ten author affiliations, which produced the highest number of Review Articles in broad subjects and the results are provided in Table 10. The Indian Institute of Science, Bangalore has occurred in all subject fields except in Medical Sciences and Agricultural Sciences.

Table 10: Affiliations of Authors, Which Produced Highest Number of Review Articles in *Science Citation Index* (2000-2005)

Chemical Sciences	BHABHA ATOM RESEARCH CENTRE-Mumbai; INDIAN INST SCI-BANGALORE-Bangalore; INDIAN INST TECHNOL BOMBAY-Mumbai; CSIR-Trivandrum; INDIAN INST CHEM TECHNOL-Hyderabad; NATL CHEM LAB-Pune; INDIAN INST TECHNOL DELHI-New Delhi; INDIAN INST TECHNOL-Kanpur; INDIAN ASSOC CULTIVAT SCI-Kolkata; INDIAN INST TECHNOL-Kharagpur
Medical Sciences	ALL INDIA INST MED SCI-New Delhi; POST GRAD INST MED EDUC & RES-Chandigarh; PANJAB UNIV-Chandigarh; SANJAY GANDHI POST INST MED SCI-Lucknow; CHRISTIAN MED COLL & HOSP-Vellore-Tamil Nadu; NATL INST PHARM EDUC & RES-Sas Nagar-Punjab; NATL INST MENTAL HLTH & NEUROSCI-Bangalore; TATA MEM HOSP-Mumbai; SEHGAL NURSING HOME-New Delhi; LV PRASAD EYE INST-Hyderabad
Biological Sciences	CENT FOOD TECHNOL RES INST-Mysore; INDIAN INST SCI-Bangalore; UNIV DELHI-New Delhi; INST MICROBIAL TECHNOL-Chandigarh; INDIAN INST TECHNOL-New Delhi; NATL INST PHARMACEUT EDUC & RES-Mohali-Punjab; CTR CELLULAR & MOL BIOL-Hyderabad; JAWAHARLAL NEHRU CTR ADV SCI RES-Bangalore; NATL INST OCEANOLOG-Panaji-Goa; INDIAN INST CHEM BIOL-Kolkata
Physical Sciences	TATA INST FUNDAMENTAL RES-Mumbai; INDIAN INST SCI-Bangalore; INDIAN INST TECHNOL-New Delhi; INTER UNIV CTR ASTRON & ASTROPHYS-Pune; BHABHA ATOM RES CTR-Mumbai; PHYS RES LAB-Ahmedabad; INDIAN INST TECHNOL Bombay-Mumbai; BANARAS HINDU UNIV-Varanasi; HARISH CHANDRA RES INST-Allahabad; UNIV BOMBAY-Mumbai
Multidisciplinary Sciences	BANARAS HINDU UNIV-Varanasi; INDIAN INST SCI-Bangalore; INDIAN AGR RES INST-New Delhi; UNIV DELHI-New Delhi; ALL INDIA INST MED SCI-New Delhi; OSMANIA UNIV-Hyderabad; G B PANT UNIV AGR & TECHNOL-Pantnagar; TATA INST FUNDAMENTAL RES-Mumbai; JAWAHARLAL NEHRU CTR ADV SCI RES-Bangalore; JAWAHARLAL NEHRU UNIV-New Delhi
Agricultural Sciences	INDIAN AGR RES INST-New Delhi; INT CROPS RES INST SEMI ARID TROP-Patancheru AP; UNIV DELHI-New Delhi; PUNJAB AGR UNIV-Ludhiana; NATL BOT RES INST-Lucknow; INT CTR GENET ENGN & BIOTECHNOL-New Delhi; UNIV HYDERABAD-Hyderabad; ALL INDIA INST MED SCI-New Delhi; PANJAB UNIV-Chandigarh; CCS HARYANA AGR UNIV-Hisar Haryana

Keyword Analysis

Keywords represent the subject content of the articles. There are a total of 16887 unique keywords, which includes both author keywords and KeywordPlus fields in *Science Citation Index*, given to the 2042 Review Articles studied. The keywords, which have occurred more than ten times are listed in Table 11 with the number of times occurred. Escherichia Coli; In Vitro; Crystal Structure; Gene Expression; and Polymerase Chain Reaction are the five most occurred keywords. Table 12 presents the highly occurred ten keywords from each broad subject category of the Review Articles.

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Table 11: Keywords (in 'Author Keywords' and 'KeyWord Plus' fields) Occurred More than 10 Times in the Review Articles in *Science Citation Index* (2000-2005)

Keywords	No. of times occurred	Keywords	No. of times occurred
Escherichia Coli	57	South India	15
In Vitro	52	System	15
Crystal Structure	51	Double Blind	14
Gene Expression	37	Epidemiology	14
Polymerase Chain Reaction	36	Hydrogen Peroxide	14
Arabidopsis Thaliana	34	Mechanism	14
Oxidation	34	Nitric Oxide Synthase	14
Performance Liquid Chromatography	30	Rate Constants	14
Human Immunodeficiency Virus	29	Review	14
India	29	Toxicity	14
Signal Transduction	28	Activation	13
Kinetics	27	Cancer	13
Pulse Radiolysis	27	Cells	13
Drug Delivery	25	Developingries	13
Nf Kappa B	25	Heavy Metals	13
Tuberculosis	25	In Vitro Evaluation	13
Derivatives	24	Management	13
Tumor Necrosis Factor	24	Mechanical Properties	13
Mycobacterium Tuberculosis	23	Plants	13
Saccharomyces Cerevisiae	22	Spectroscopy	13
Nitric Oxide	21	Water	13
In Vivo	20	Bacillus Subtilis	12
Growth	19	Biosynthesis	12
Identification	19	Coatings	12
Nuclear Magnetic Resonance	19	Evolution	12
Behavior	18	Insulin Resistance	12
Central Nervous System	18	Oryza Sativa L	12
Galaxies	18	Solid State Fermentation	12
Infection	18	Systems	12
Oxidative Stress	18	Tissue Culture	12
Therapy	18	X Ray Diffraction	12
Diagnosis	17	Acid	11
Expression	17	Binding	11
Risk Factors	17	Brain	11
Aqueous Solution	16	Breast Cancer	11
Children	16	Chemistry	11
Coronary Heart Disease	16	Degradation	11
Disease	16	Density Functional Theory	11
Model	16	Diels Alder Reactions	11
Molecular Structure	16	Drinking Water	11
Resistance	16	Escherichia Coli K 12	11
Stereoselective Synthesis	16	Free Radicals	11
Temperature	16	Inhibition	11
Apoptosis	15	Lipid Peroxidation	11

Table continued on next page

Aqueous Solutions	15	Low Density Lipoprotein	11
Electron Transfer	15	Organic Synthesis	11
Gene	15	Plasma Mass Spectrometry	11
Prevalence	15	Reduction	11
Programmed Cell Death	15	Ring Opening Polymerization	11
Protein	15		

Table 12: The Most Occurred 10 Keywords (in 'Author Keywords' and 'KeyWord Plus' fields) in the Broad Areas of the Review Articles in *Science Citation Index* (2000-2005)

Subject Area	Keywords
Chemical Sciences	Crystal Structure; Oxidation; Pulse Radiolysis; Derivatives; Kinetics; Molecular Structure; Stereoselective Synthesis; Aqueous Solution; Behavior; Electron Transfer
Medical Sciences	Polymerase Chain Reaction; Human Immunodeficiency Virus; In Vitro; Tuberculosis; Mycobacterium Tuberculosis; Drug Delivery; Risk Factors; Children; Diagnosis; Therapy
Biological Sciences	Escherichia Coli; Saccharomyces Cerevisiae; Crystal Structure; In Vitro; Aspergillus Niger; Arabidopsis Thaliana; Nf Kappa B; Solid State Fermentation; Activation; Signal Transduction
Physical Sciences	Galaxies; D Branes; Black Holes; Supersymmetric Standard Model; Cosmological Constant; Cosmology; General; Heavy Ion Collisions; Mass Transfer; Stars
Multidisciplinary Sciences	Gene Expression; Arabidopsis Thaliana; Escherichia Coli; Oryza Sativa L; Oxidative Stress; In Vitro; Signal Transduction; Crystal Structure; Insulin Resistance; Nf Kappa B
Agricultural Sciences	Arabidopsis Thaliana; Oryza Sativa; Genetic Transformation; Photosystem 2; Resistance; Agrobacterium Mediated Transformation; Coronary Heart Disease; Escherichia Coli; Chlamydomonas Reinhardtii; Gene Expression

Synchronous References

Synchronous references show the depth and recency of the subject the Review Article is dealing with. Table 13 presents the descriptive statistics of the Synchronous References observed in the 2042 Review Articles. It also complements the Review Articles written in collaboration of other highly collaborated countries.

The number of authors in the Review Articles and Number of Synchronous References are taken into consideration keeping the view that if there is more number of authors, there may be a chance of having more Synchronous References. The analysed correlation between number of authorships and average number of Synchronous References is shown in Figure 3. There is not much correlation is observed between the two variables.

The numbers of Synchronous References in each 2042 Review Articles are observed and it has been found that some numbers are repeating. This phenomenon is presented with the help of a graph presented in Figure 4. The repeating nature can be seen more on the centre part of the graph.

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Table 13: Descriptive Statistics of Synchronous References Observed in the Review Articles in *Science Citation Index* (2000-2005)

Descriptive statistics	All	Only India in affiliation	Review Articles written in collaboration with						
			USA	Germany	Japan	England	France	Canada	Peoples-R-China
Mean	112.48	106.41	145.17	174.62	205.34	174.61	233.12	249.06	124.41
Standard Error	2.58	2.36	17.00	39.06	69.98	73.76	87.38	93.63	13.67
Median	99	93	110	115	111.5	105	128	143.5	113
Mode	103	103	103	107	87	34	107	103	NA
Standard Deviation	116.58	93.90	237.41	347.16	464.17	472.27	509.50	529.66	71.02
Sample Variance	13590.58	8816.39	56365.28	120520.08	215452.37	223039.74	259592.11	280538.96	5043.94
Kurtosis	245.35	104.90	124.98	66.34	37.05	39.30	32.95	29.38	-1.04
Skewness	11.24	6.33	10.33	7.85	5.91	6.21	5.70	5.33	0.30
Range	3095	1989	3088	3088	3088	3091	3034	3065	246
Minimum	1	1	8	8	8	5	62	31	21
Maximum	3096	1990	3096	3096	3096	3096	3096	3096	267
Sum	229678	168025	28308	13795	9035	7159	7926	7970	3359
Count	2042	1579	195	79	44	41	34	32	27

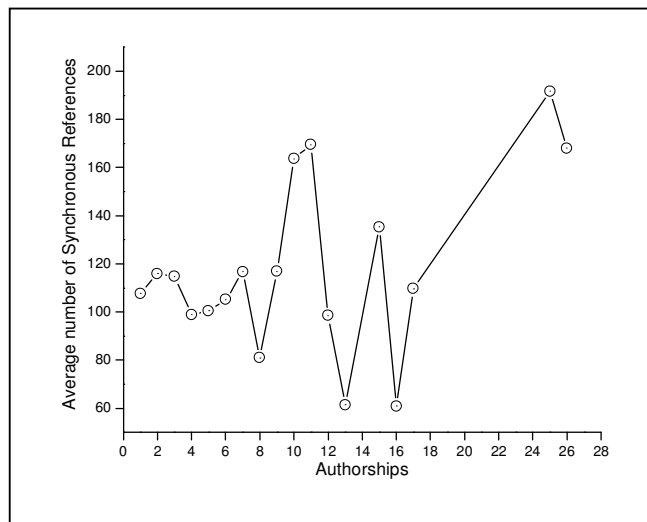


Figure 3: Correlation between Number of Authorships and Average Number of Synchronous References Occurred in Review Articles in *Science Citation Index* (2000-2005)

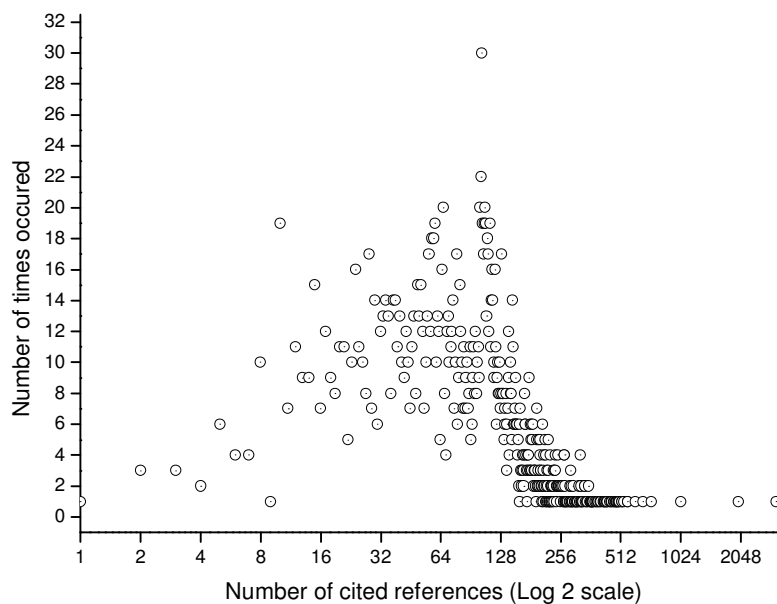


Figure 4: Correlation of Number of Synchronous References and their Number of Times Occurred in the Review Articles in *Science Citation Index* (2000-2005)

CONCLUSIONS

Gradual growth is observed in the number of Review Articles by Indian authors being published in recent years. More than 85 per cent of the Review Articles are written in collaboration with more than one author. There is a scope for further comparative study of nature of collaboration of normal articles and Review Articles. It is logical that work involved in writing a Review Article is more than writing a normal article. Collecting the available literature in a field, even in a micro field, is a cumbersome work. The collaborative works gain more importance in such situations. Indian Institute of Science, Bangalore; All India Institute of Medical Sciences, New Delhi; Bhabha Atomic Research Centre, Mumbai; Indian Institute of Technology, New Delhi; and Delhi University, New Delhi are the premier institutions which produced more number of Review Articles. The study finds that collaboration of Indian reviewers with people from outside India is significant. *Current Science*; *Research on Chemical Intermediates*; *Indian Journal of Medical Research*; *National Medical Journal of India*; and *Progress in Organic Coatings* are the top five journals publishing Review Articles of Indian origin. One third of the Review Articles taken into consideration for the study are published in journals having Impact Factors ranged from zero to one.

Multidisciplinary Sciences; Chemistry in General; General and Internal Medicine; Biochemistry and Molecular Biology; and Pharmacology and Pharmacy are the main fields in which the majority of the Review Articles are written. Authors from Indian Institute of Science, Bangalore contributes Review Articles of various subject areas than any other affiliations of authors. Escherichia Coli; In Vitro; Crystal Structure; Gene

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Expression; and Polymerase Chain Reaction are the five most occurred keywords found in the Review Articles. The inter-quartile mean of the number of Synchronous References of the 2042 Review Articles is found to be 94.84.

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