Annals of Library and Information Studies
Vol. 60, September 2013, pp. 195-203

A scientometric profile of Prof. Lalji Singh as seen through Web of Science and Scopus

Bhaskar Mukherjee

Associate Professor, Department of Library & Information Science, Guru Ghasidas University, Bilaspur,
Email: mukherjee.bhaskar@gmail.com

Received 25 April 2013; revised 24 July 2013

The paper presents the bibliometric characteristics including authorship pattern, citations received and relative performance of Prof. Lalji Singh an eminent Indian scientist in the field of genome analysis, DNA finger printing, etc. The study is based on the publication data indexed in Web of Science and Scopus. Results show that 222 unique articles have been indexed in the two databases with an average of 7-8 articles per year. Of the 222 articles only 18 articles appeared in Indian journals. Most of the articles were published when he served at Centre for Cellular and Molecular Biology, Hyderabad during 1987-2011. Authorship pattern of Prof. Singh indicates that he is serving as a leader of his research term and K Thangaraj is the fellow scientist with whom he wrote most. Almost all his articles appear in high-impact journals. The h-index of Prof. Singh is 30 in both the databases. He has received fellowships of all major national science academies as also third world academy. The study concludes with a remark that Prof. Singh can be a 'role model' for younger research to follow.

Keywords: Lalji Singh, Scientometric, Bibliometric profile

Introduction

India is perhaps one of the few cultures of the world where the pursuit of science has been more or less continuous from the earliest to the present. From the 5th to the 12th centuries, Indian science saw its greatest flowering when Aryabhatta, Bhaskara, Brahmagupta, and others contributed a lot to the fields of mathematics, astronomy, and chemistry. But science in India suffered a decline after the 12th century because of various reasons. In the last 66 years of independence, India has developed quite a big research infrastructure with over 550 universities, 15,600 colleges, 17 IITs, 13 IIMs and a number of R&D institutes. However India is beginning to trail in comparison not only with other countries but also with its own past performance. PM Manmohan Singh, in his speech at the 99th Indian National Science Congress, Bhubhneshwar, mentioned that "India's relative position in the world of science had been declining and we have been overtaken by countries like China."

The nagging problem may be multifaceted- including funds, infrastructure or government policies, lack of spirit, personal interests, dedication etc. The great scientist, C.V. Raman once mentioned , "What we lack is perhaps courage, what we lack is perhaps a driving force which takes one anywhere. … I think what is needed in India today is a destruction of the defeatist spirit".

The PM, at the Science Congress, addressed how students of sciences opted for non-science careers after education. "While it is true that science and engineering continue to attract the best students, many of them later opt for other careers because of poor prospects in science." He also referred to a recent survey of 2000 Indian women PhD holders in science which had found 60% of them unemployed. The main reason was discrimination and unlike the public image, 'family reasons' was cited by only a few in explaining their unemployment. Public image is one of the encouraging factors for improvement of life.

K.S. Krishnan writing a book review commented that "most of the developing countries lack 'role model' to motivate other scientists. One of the factors that have inspired more men/women to pursue scientific careers has been having examples of successful men/women who have done the same. There are only few individuals and institutions of excellence now in India. Individuals are the basic foundations of any institution. If we can highlight those individuals who have reached the top positions in academic and research life, as role-model scientist

in their respective fields, it may stimulate the younger generation to emulate them. This pro-active process may also help our younger scientists to prove themselves as another significant scientist in their domain. In the present study, we study Prof. Lalji Singh's research career through the analysis of his research papers.

A brief profile of Prof. Lalji Singh

Prof. Lalji Singh (hereinafter Prof. Singh) was born on 5th July 1947 in Jaunpur, Uttar Pradesh. After completing Masters Degree in Zoology from Banaras Hindu University in 1966, he joined research and was awarded Ph.D. in 1971 for his work on "Evolution of karyotypes in snakes" from the same university. He started his scientific career as Research Associate at the Department of Zoology, Banaras Hindu University during 1970-1972 and later on was Pool Officer at the Calcutta University during April - September 1974. By his dedication, hard work and intelligence, he received Commonwealth Fellowship and went to Europe in 1974 to carry out research at the Edinburgh University U.K from 1974 to 1976. He worked with Calcutta University as Guest Scientist (October 1976 - April 1977), Edinburgh University, U.K. as Research Associate (October 1977 to 1979), Australian National University, Canberra, as Visiting Fellow (July to September 1979) and again Edinburgh University, U.K. as Research Associate (October 1979 to May 1987). In June 1987 Prof. Singh joined Centre for Cellular and Molecular Biology (CCMB), Hyderabad as senior scientist. In July 1998 he joined as Director of CCMB. After serving as Head of one of the premier R&D institute for almost 15 years, in August, 2011 he joined as Vice-chancellor of Banaras Hindu University–one of the most prestigious universities in India. He has shown his research expertise in the fields including molecular basis of sex determination, DNA fingerprinting, wildlife conservation, silkworm genome analysis, human genome and ancient DNA studies. He is the recipient of so many awards. Some important milestones include:

- 1973: Dr S P Basu Memorial Medical – for outstanding contribution in the field of Cytogenetics [Zoological Society, Calcutta]
- 1974: INSA Medal for Young Scientists [Indian National Science Academy, New Delhi]
- 1974-76: Commonwealth Scholarship – for Postdoctoral Research in Molecular Biology at Edinburgh University, UK [Commonwealth Commission, UK]
- 1992: CSIR Technology Award – for biological sciences [Council of Scientific & Industrial Research, New Delhi]
- 1995: Professor Vishwanath Memorial Lecture Award [Indian National Science Academy, New Delhi
- 1998: Indian Academy of Neurology Oration [Indian Academy of Neurology, Bangalore]
- 1998: Scroll of Honour: Outstanding Forensic Expert Award – for Indianization of DNA Fingerprinting Technology [The Medico Legal Society, All India Institute of Medical Sciences, New Delhi]
- 2002: TWAS Fellowship [Third World Academy of Sciences Trieste, Italy]
- 2002: New Millennium Plaques of Honour – 2001-2002 award for outstanding services in the field of Biological Sciences [By the Prime Minister of India at the 89th Session of the Indian Science Congress-2002]
- 2003: Vigyan Gaurav Award [Council of Science & Technology, Government of Uttar Pradesh]
- 2004: Honorary D.Sc. degree [Banaras Hindu University, Varanasi]
- 2004: Padma Shri [Government of India]
- 2004 : FICCI Award 2002-03 for R&D in Life Sciences [Federation of Indian Chambers of Commerce and Industry, New Delhi]
- 2006 : J C Bose National Fellowship [Department of Science & Technology]
- 2007 : Sir Edward Mellanby Memorial Lecture [Central Drug Research Institute, Lucknow]
- 2008 : CSIR Technology Award for Life Sciences – 2008 [CSIR, New Delhi]
- 2009: Life Time Achievement Award for the year 2008 [Biotech Research Society (BRSI), BHU, Varanasi] during 6th BRSI Convention and International Conference, ETBT-2009, Banaras Hindu University, Varanasi
- 2009: Life Time Achievement Award [Indian Analytical Instruments Association, Hyderabad]
- 2009: CSIR Bhatnagar Fellowship [CSIR, New Delhi]
- 2010: B P Pal Memorial Award [97th Indian Science Congress]

He is also an elected fellow of Fellow of Indian Academy of Sciences, National Academy of Sciences,

Indian National Science Academy, National Academy of Agricultural Sciences, National Academy of Medical Sciences and Third World Academy of Sciences.

There are many scientific discoveries by Prof. Singh in the field of genome analysis, DNA finger printing etc. Bkm-derived probe for DNA fingerprinting as an alternative mechanism of the determination of sex is one of the significant contribution among them. The technique was used to investigate the cases like assassination of the late Prime Minister Shri Rajiv Gandhi and assassination of Punjab Chief Minister and others. It was the first time in the annals of the history of Indian Judiciary when DNA fingerprinting was accepted as infallible evidence in the court of law. Presently, DNA fingerprinting is being extensively used for forensic investigation, paternity determination and seed stock verification.

Another significant contribution by Prof. Singh and his team is the development of a novel DNA based mechanism which, without knowing the history of a forensic sample, is able to establish whether a drop of blood or tiny piece of meat belongs to human or animal. And if animal, to which species of the animal is. He along with his group have set up diagnostic services for many genetic disorders such as sickle cell anemia, Alzheimer's disease, BCD, male infertility, pancreatitis, Robert's syndrome, etc.

Prof. Singh's study on genetic diversity in primitive tribes of India including the tribal populations of Andaman and Nicobar Islands using Y-chromosomal markers and mtDNA sequences is well known. The findings of the study, which has published in *Science*, indicates that the Andamanese have closer affinities to Asian than to African population and suggests that they are the descendants of the early Paleolithic colonizers of Southeast Asia – the hunter gatherers and the first migrants who moved out of Africa about 60,000-100,000 years ago.

Analyzing the research papers of Prof. Singh using bibliometric techniques can help in understanding the profile of the eminent scientist.

Earlier works

Individual scientists including the Nobel Prize winners have been the focus of scientometric studies for quite sometime[1-3]. Kalyane[4] studied the scientometric portrait of P.M. Bhargava based on his research papers, including, collaboration pattern, communication channels and keywords. The work of Kalyane, Prakasan, & Vijai Kumar[5] is also in same direction for biologist Ranjit Kumar Mitra. Sinha and Bhatnagar's[6] study was on R.C. Sinha, a renowned plant pathologist of Canada. Skalka-Zlatt and Zbikovska-Migon[7] have studied the presence of Price's contributions in Polish scientific literature. Rusthon[8] describes Hans Eysenck's productivity, in relation to his scientific achievement. There are many more studies on cement and concrete chemist, agricultural scientist; a nuclear scientist, chemical engineers and so on[9-17].

There has been considerable interest in studying how the eminent scientists collaborate? One of the results of studies on present-day scientists has shown that productive scientists reveal a more intensive co-operation and have a greater number of co-operation partners than less productive ones[18]. Thus it could be concluded that the efficacy of research groups might be dependent on intellectual interaction between their members. Beaver[19] however, in his paper claimed that although the most productive researchers are disproportionately involved in joint research, the association of collaboration and productivity is problematic because it appears that collaboration by itself may not increase productivity.'

Prpić[20] in his study found that the average scientific productivity of eminent researchers is not only several times larger but also shows a more intensive scientific collaboration and orientation towards the international scientific arena. The most important predictors of the elite's productivity are also qualificational and organizational variables but of a more selective nature. Interestingly, his study found that eminent scientists did not achieve a better school record in secondary school than the representatives of all researchers. However, they did better at the university. Even more indicative is the fact that the eminent more often participated in research along with their university obligations than it was the case with the members of the research population. Prominent researchers, more often than other colleagues, have a continuous scientific career. If they did not start in science, they came into the field at an average age of 35 years. The successful scientists usually speak two foreign languages and have a passive knowledge of another two languages. The differences between the eminent scientists and the research population can easily be noticed in the level of professional integration. The former are on the average members of two (2.3) national and more than one (1.5) international scientific societies, while an average percentage for the latter amounts to 1.0 national and 0.3 international associations.

Kalyane and Kalyane[9] first used the phrase 'Scientometric Portrait' to carry out bio-bibliometric studies on scientists. The term 'Bio-bibliometrics' is being used for a method of retrieving and visualizing biological information that uses co-occurrence of gene naming terms in Medical Sciences to generate semantic links between genes. Therefore, it is suggested that 'Scientometric portrait' is the appropriate phrase for the studies on scientists, and 'Informetric portrait' for the studies on researchers in other disciplines such as arts, humanities, and social sciences.

Objectives of the study

- To explore the authorship pattern, collaborative research pattern of Prof. Lalji Singh'sresearch;
- To identify the relative performance of published work on the basis of published journal reputation;
- Too compare the research output, in terms of the number of citations received, and how far his top cited works have importance in present context.

Methodology

The data presented in this paper have been accessed both from Web of Science (WOS) published by Thomson Scientific and *Scopus* published by Elsevier. The basic data, relating to the bibliometric characteristics of Prof. Singh were collected using the 'Author Finder' option in WOS and 'Author Search' option in Scopus. The searching was conducted during July-August 2012. Due to non-availability of exact name search facilities in both the databases, the search results were refined with the affiliation of the author. Affiliation of the author is determined by the authors' addresses that appeared in every article along with the year of published works. In order to confirm different affiliation of Prof. Singh in the last few years, the official website of CCMB was used. All the searched results were first saved in tab-delimited text files and then imported into Microsoft Excel for analysis. Although the total number of publications was identified, we did not include articles classified as 'Erratum', 'Review,' 'Book review,' 'Bibliography,' 'Editorial materials,' 'Meeting abstract,' 'Conference Proceedings', 'Book Chapter' etc. in our study. We considered articles indexed only in the SCI & Scopus database.

We measured the research performance of Prof. Singh over the last few years on the basis of two criteria: the quantity of articles as well as the impact factor. The impact factor of ISI and SJR value of Scopus of the contributing journals during 2011 was considered as a quality indicator. Finally, the product of the number of articles published in a journal multiplied by the impact factor & SJR value of the same journal was considered as a combined indicator of the quality of research productivity. The sum of the above products from all journals was considered a "total research performance". In order to represent the data in a reasonable manner we have mentioned here only top twenty such results.

To judge the scholarly impact of all research output of Prof. Singh, we have counted the absolute citations received up to July 2012 by individual articles published during 1968-2011 under both solo and joint authorship in both these two databases. Each author of a joint paper was credited with having received an equal share of the total number of citations to that paper.. Data were also compared with the related findings in the previous studies. Mean citation of these two database for individual article is considered as a base to judge the scholarly impact.

Analysis

Publication pattern

An attempt was made to analyse the amount of literature that has been contributed by Prof. Singh during 1968-2011. There are 222 articles indexed in the two databases. The year-wise contribution of articles has been shown in Figure 1. As shown in the figure, in the last 36 publication years, Prof. Singh has contributed on an average of 7-8 articles per year, while, no publication have been noted during 1973-75, 1978, and 1989-1991. Highest number of articles appeared in 2006 (27 articles) followed by 2007 and 2008 (19 articles each year) and 2009 (16 articles).

It has been reported that mathematicians publish more in early life and biologists work more in the middle years of their career[14]. Prof. Singh was born on July 5, 1947. He was most productive from 2000 onwards. Two peak periods of high scholarly productivity of Prof. Singh have been observed, in five year period cycle, during 2001-2005 (having 12 papers per year) and 2006-2010 (having 20 papers per year) when he was at the age of 54-58 and 59-63, respectively. Zuckerman[22] in his study finds that scientist's age is an important criterion with their scholarly productivity. If scientific productivity declines with age, then scientific capacity may be affected by an older age structure in science. However, there is as such no decline observed in

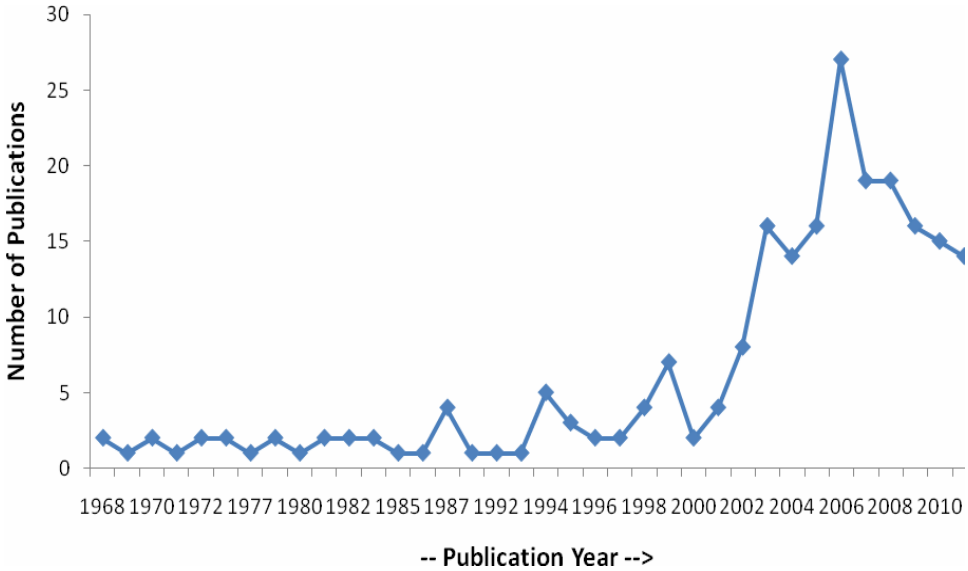

Fig.1—Publication profile by year

publishing profile of Prof. Singh in spite of his age and increasing oranizational responsbebilities. Lehman[23], in this regard mentioned that publishing productivity of a genius may not always be affected by his/her age. Nobel Laureate Prof. H.C. Brown and Prof. Sir Neville Mott have done very original researches after their age of 70 and 67 respectively.

It is worth mentioning that Prof. Singh has served various organizations of national and international repute throughout his career. In Table 1, we mention such organizations where Prof. Singh has served and identify the percentage of scholarly research.

Co-authorship pattern

Collaboration is defined as the co-occurrence of two or more addresses on a publication. Of the total 222 articles of Prof. Singh, he wrote 5 articles under single authorship, 13 articles in two authorship, 36 articles in three authorship, 20 articles in four authorship, 26 articles in five authorship, 33 articles in six authorship, 21 articles in seven authorship, 20 articles in eight authorship, 17 articles in nine authorship, 4 articles in ten authorship and remaining, 35 articles in more than ten authorship. One article contains 155 authors and another article contains 100 authors.

Scientific research collaboration is a growing phenomenon and the proportion of co-publications in the total number of scientific publications has also been steadily increasing[24]. As shown in Fig. 2, the proportion of co-authorship articles of Prof. Singh has grown considerably from 1995 onwards. With the advent of Internet, proximity between research groups has decreased. Additionally, research increasingly depends on the combination of the knowledge and skills of researchers from different subfields. The costs of research facilities are increasing rapidly, especially in sciences such as physics or life sciences. Resources are consequently more and more pooled at the regional, national and sometimes international level which forces researchers from different research organisations to collaborate more intensively. There is an increasing need for specialisation in those fields where the instrumentation is becoming more and more complex[25].

There are at least 805 different authors who have collaborated with Prof. Singh in various articles. Table 2 lists top ten authors with whom Prof. Singh has contributed most. Among them Kumarasamy Thangaraj; A. Govardhana Reddy and Gyaneshwer Chaubey –from CCMB, are top three collaborators with whom more than 70 percentage of publications resulted. In scientific research, collaboration may not readily emerge in a newly formed research center because people who are asked to work together may not have established the required scientific or professional compatibility, interpersonal relationship or trust, which is a necessary foundation. Such collaboration relies on the coincidence of people making personal connections. This collaboration is something that occurs quickly as people find that they enjoy working together and the synergy resulting from working together produces something that

Table 1—Publication vis-à-vis-organization

Organizations served	Active years	Total publication	%
Cytogenetics Laboratory, Dept. of Zoology, Banaras Hindu University	5 years (1967-1972)	7	3.15
Calcutta University	13 months (April – September 1974 & October 1976 – April 1977)	1	0.45
Institute of Animal Genetics, Edinburgh University, UK	12 years (1974 to 1976, 1977-79 and 1979-87)	13	5.86
Inst. Hum. Genet., Univ. Freiburgi, Germany	Not available	1	0.45
Australian National University, Canberra	3 months (July to September 1979)		
Centre for Cellular and Molecular Biology Hyderabad	24 years, 6 months (June 1987 to July 2011)	200	90.09

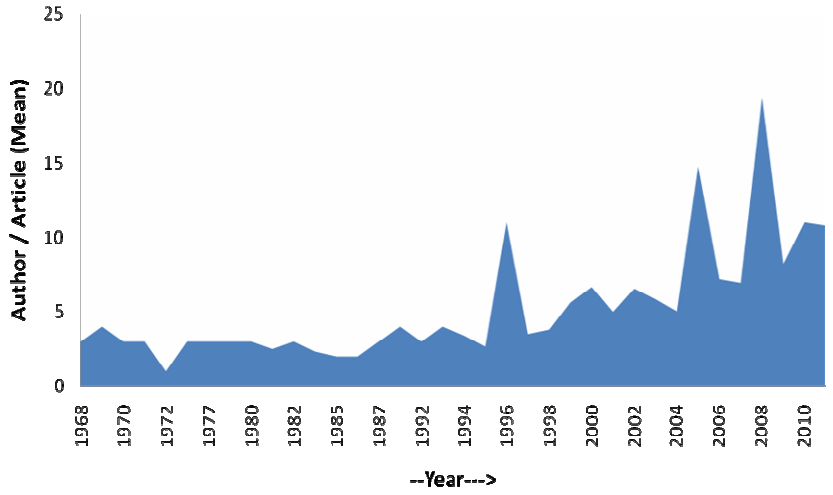

Fig. 2—Proportion of co-authorship

Table 2—Top Ten co-authors

Sl. no.	Co-author name	Total co-authored articles (%)	Effective years			Co-authors affiliation
			From	To	Total years	
1	Thangaraj, K.	100 (44.84)	1996	2011	15	CCMB, Hyderabad
2	Reddy, A.G.	42 (18.83)	2002	2011	9	CCMB, Hyderabad
3	Chaubey, G.	23 (10.31)	2005	2011	6	CCMB, Hyderabad
4	Deenadayal, M.	20 (8.97)	2004	2011	7	Infert. Inst., Hyderbad
5	Gupta, N.J.	27 (12.11)	1998	2011	13	Inst Repord. Med., Kolkata
6	Jones, K.W.	19 (8.52)	1976	1988	12	Inst. Anim. Genet., Edinberg
7	Kivisild, T.	16 (7.17)	2005	2011	6	Estonian Biocenter, Tartu
8	Reddy, B.M.	17 (7.62)	2004	2011	7	ISI, Kolkata
9	Aggarwal, R.K.	15 (6.73)	1992	2009	17	CCMB, Hyderabad
10	Chakravarty, B.	17 (7.62)	2002	2011	9	IRM, Kolkata

would not occur if those involved were working alone—the whole is greater than the sum of its parts.

Relative performance of research by journal impact

It always remains an ambition of any researcher to disseminate findings through those journals which are well recognized in their respective fields. Well recognized journals are those that follow rigorous peer-review process. Quantity along with relative impact of journal is an important issue to consider the performance of publication. Performance indicators help to identify the level of quality of the work of an

Table 3—Relative performance of research by journal

Sl. no.	Journal name	Total articles	IF	SCImago	Relative performance
1	*Cell*	2	32.403	9.428	83.662
2	*Science*	2	31.364	5.425	73.578
3	*Chromosome*	11	3.847	1.234	55.891
4	*Journal of Andrology*	12	3.141	1.324	53.58
5	*American Journal of Human Genetics*	4	10.603	2.479	52.328
6	*Human Genetics*	8	5.069	0.026	40.76
7	*Lancet*	1	38.278	1.49	39.768
8	*Nature*	1	36.28	7.767	44.047
9	*Nature Genetics*	1	35.532	8.923	44.455
10	*Gut*	3	10.111	0.883	32.982
11	*PLoS Genetics*	3	8.694	1.813	31.521
12	*PLoS One*	6	4.351	0.519	29.22
13	*Human Reproduction*	6	4.357	0.345	28.212
14	*Nucleic Acids Research*	3	7.836	1.542	28.134
15	*European Journal of Human Genetics*	4	4.4	0.459	19.436
16	*Molecular Biology and Evolution*	3	5.51	0.795	18.915
17	*Molecular Phylogenetics and Evolution*	5	3.56	0.194	18.77
18	*Electrophoresis*	5	3.303	0.335	18.19
19	*Human Molecular Genetics*	2	7.636	1.308	17.888
20	*Genome Biology*	2	6.885	1.66	17.09

Table 4—Citation profile of significant (n>=100) works

Sl. no.	Title	Year	Journal	Citations
1	Sex reversal in the mouse (Mus-Musculus) is caused by a recurrent nonreciprocal crossover involving the X-chromosome and an aberrant Y-chromosome	1982	*Cell*	231
2	The use of heparin as a simple cost-effective means of controlling background in nucleic-acid hybridization procedures	1984	*Nucleic Acids Research*	225
3	Sex-chromosome associated satellite DNA - evolution and conservation	1980	*Chromosome*	136
4	Reconstructing Indian population history	2009	*Nature*	135
5	Reconstructing the origin of Andaman Islanders	2005	*Science*	131
6	The conserved nucleotide-sequences of Bkm, which define Sxr in the mouse, are transcribed	1984	*Cell*	126
7	Satellite DNA and evolution of sex-chromosomes	1976	*Chromosome*	121
8	Genome-wide analysis of microsatellite repeats in humans: their abundance and density in specific genomic regions.	2003	*Genome Biology*	110
9	Recent male-mediated gene flow over a linguistic barrier in Iberia, suggested by analysis of a Y-chromosomal DNA polymorphism	1999	*American Journal of Human Genetics*	104
10	Genetic landscape of the people of India: A canvas for disease gene exploration	2008	*Journal of Genetics*	100

Note: Citation profile is based on WOS and SCOPUS databases both.

author or research group and can be used to gauge the impact of the research on the scientific community.

There are almost 113 journals, where the work of Prof. Singh has been published. Of the 113 journals, 62 journals have the impact factor more than 2. We have identified top twenty such journals which have higher relative impact and measure the relative performance of Prof. Singh's research. Table 3 shows the results in decreasing relative journal performance value. It is obvious that authors publishing only one or few articles during a life time can hardly contribute to the progress of science. Naturally, not all publications of long term authors contains a noticeable scientific contributions, but they 'Set the fashion' on the development of science[26]. The relative performance of Prof. Singh research is quite impressive.

Citation analysis

After publication, research results are used by other researchers for their own studies and cited as references in their subsequent articles. Citing of one article by another is characteristic of scientific publications, and it is generally accepted that the number of citations of a particular article is a reflection of its impact in the scientific community. How often an article, an author, or a journal is cited by others is an indication of performance—the higher the number of citations, the higher the level of performance[27].

As per WOS and Scopus record, the total 222 works of Prof. Singh have been cited 3978 (up to July 2012) times with an average of 17.83 citations per paper. The H-index in both the databases is 30 which means at least 30 papers of Prof. Singh have been cited 30 or more times. There are 10 articles which have been cited 100 times or more, 5 articles in between 75 and 100 times, 7 articles in between 51-74 times, 25 articles in between 25-50 times, 99 articles in between 5 to 24 times, and 48 articles in between 1-4 times. Overall there are only 29 articles which have not received any citation up to July 2012. Table 4 gives the top 10 works that have received 100 or more citations.

Conclusion

Prof. Lalji Singh's publication productivity under study for 43 years (1968 – 2011) during which he has published 222 papers indicated that his productivity increased after his 53 percentile age i.e. from 2000 onwards. The percentage of collaborative work of the scientist was found to be very high as he had as many as 98% collaborative works with 805 collaborators with whom he work in various organizations. Among them Kumarasamy Thangaraj; A. Govardhana Reddy and Gyaneshwer Chaubey –from CCMB, are top three collaborators with whom more than 70 percentage of publicationsresulted. The scientist worked in highly specialsed fields like genetic fingerprinting. His papers have been scattered in 113 scientific journals, out of which 62 journals have the impact factor more than 2. He received many awards and honours including the Padma Shri in 2004. His total articles have been cited with an average of 17.83 citations per paper. The present H-index of Prof. Singh has reached to 30 which is rare among Indian Scientists. There are 10 articles which have been cited 100 times or more, which indicates the scientific value of his works.

It is obvious that science has grown exponentially over the twentieth century and that all disciplines have given rise to many specialties to such an extent that the fragmentation of science makes it more difficult now than ever to identify an obvious role-model for a discipline as a whole. Whereas it was still relatively easy around 1950 to know who the most important scientists in a discipline were, such a judgment is much more difficult since at least the 1990s.

The continuous publication efficiency of Prof. Singh indicates his meritorious services, dedication towards work and passion towards research. He can be considered as 'role model' for younger research to follow. In the 21st century knowledge based economy, mind power and imagination is more important than money. What we need today is spirit among young generation to inculcate innovative mind power and imagination.

References

1 Gingras Y and Wallace M L, Why it has become more difficult to predict Nobel Prize winners: a bibliometric analysis of nominees and winners of the chemistry and physics prizes (1901–2007), *Scientometrics,* 82 (2010) 401–412

2 Kademani B S and Kalyane V L, Bibliometric indicators of publication productivity of analysis of an individual scientist, *JISSI: The International Journal of Scientometrics and Informetrics*, 2 (4) (1996) 49 -58.

3 Kademani B S, Kalyane V L and Jange S, Scientometric portrait of Nobel laureate Dorothy Crowfoot Hodgkin, *Scientometrics,* 45(2) (1999) 233 – 250.

4 Kalyane V L, Scientometric portrait of P.M. Bhargava, *Lucknow Librarian*, 27(1-4) (1995) 42-70.

5 Kalyane V L, Prakasan E R and Kumar V , Scientometric portrait of Ranjit Kumar Mitra, *ILA Bulletin*, 37(2) (2001) 39-53.

6 Sinha S C and Bhatnagar I M S, The information profile of a plant pathologist, *Annals of Library Science and Documentation* , 27 (1980) 106-113.

7 Skalka-Zlatt M and Zbikovska-Migon A, Derec de Solla Price's presence in the Polish scientific literature; a citation analysis, Paper presented at the 4th International Conference on *Bibliometrics, Informetrics and Scientometrics*, Berlin, 11-15 September (1993).

8 Rusthon J P A, Scientometric appreciation of H. J. Eysenk's contributions to psychology, *Personality and Individual Differences*, 31 (2001) 17 – 39.

9 Kalyane V L and Kalyane S V, Scientometric portrait of Vinodini Reddy, *Journal of Information Science, 4* (1) (1993) 25-47.

10 Sinha S C and Ulla M F, Citation profile of Dr. V. S Ramachandran – a bibliometric analysis of his highly cited articles and books in the area of cement and concrete chemistry, *Annals of Library Science and Documentation*, 40 (1993) 21-31.

11 Kalyane V L and Kalyane S V, Scientometric portrait of M S Swaminathan, *Library Science with a Slant to Documentation and Information Studies,* 31 (1994) 31-46.

12 Kalyane V L and Devarai R S, Informetrics on C S Venkata Ram, In: *New Horizons in Library and Information Science, Dr. Velagala Venkatappaiah Festschrift*, Hyderabad (1994).

13 Peters H P F and Raan A F J V, A bibliometric profile of top scientists: a case study in chemical engineering, *Scientometrics* , 29(10) (1994) 115-36.

14 Kademani B S and Kalyane V L, Outstandingly cited and most significant publications of R Chidambaram: A nuclear physicist, *Malaysian Journal of Library and Information Science, 1*(1) (1996) 21-35.

15 Kalyane V L and Sen B K, Scientometric portrait of C. R. Bhatia, a geneticist and plant breeder, *Malaysian Journal of Library and Information Science*, 3(1) (1998) 25 – 42.

16 Kalyane V L and Sen B K, Research productivity of Tibor Braun: An analytical chemist – cum scientometrician , *Annals of Library and Information Studies*, 50(2) (2003) 47 – 61.

17 Munnolli S S and Kalyane V L, Scientometric portrait of Ram Gopal Rastogi, *Annals of Library and Information studies,* 50(1) (2003) 1-17.

18 Pelz D C and Anrews F M , *Scientists in Organisations*. Ann Arbor, Michigan: Institute for Social Research, The University of Michigan, 1976.

19 Bevaver D de B, Collaboration and Teamwork in Physics, *Journal of Physics*, B36 (1986) 14-18.

20 Prpic K , Characteristics and determinants of eminent scientists' productivity, *Scientometrics*, 36(2) (1996) 185-206

21 Koganurmath M M , Angadi M , Kademani B S, Kalyane V L And Jange S, Physics Nobel Laureate Wolfgang Ketterle: A scientometric portrait, Knowledge Management in Special Libraries in Digital Environment, XXIV All India Conference of IASLIC, Dehra Dun, 15-18 December, 2003. SIG: Informetrics, Theme: Biobiblimetrics ; Special publication 43; 2003. Available at eprints.rclis.org/ 4637/1/Ketterle-Wolfgang.pdf

22 Zuckerman H, *Scientific elite* (Free Press: New York) 1977.

23 Lehman H C, *Age and achievement*, (Princeton University Press: Princeton, NJ:) 1953.

24 Wagner-Doebler R, Continuity and discontinuity of collaboration behaviour since 1800 from a bibliometric point of view, Scientometrics, 52 (2001) 503–517.

25 Gordon MD , A critical reassessment of inferred relations between multiple authorship, scientific collaboration, the production of papers and their acceptance for publication ,*Scientometrics*,2 (1980) 193–210.

26 Trofmenko A P, Scientometric analysis of the development of nuclear physics during the last 50 years, Scientometrics, 11(3) (1987) 231-250.

27 Durieux V and G P A, Bibliometric Indicators, *Quality Measurements of Scientific Publication, Radiology*, 255 (2010) 342-351.