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Scientometric Portrait of Nobel Laureate Venkatraman Ramakrishnan

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Abstract: The study presents an analysis of 165 research papers by Nobel Laureate Venkatraman Ramakrishnan published during 1977 to 2019 in the diverse field of science such as Biochemistry, Genetics and Molecular Biology, Medicine, Chemistry, Neuroscience, Immunology and Microbiology, Physics and Astronomy, Engineering and Materials Science. The highest number of publications contributed during the 2nd and 4th decade with 49 (29.70%) papers each. His paper entitles “Structure of the 30s ribosomal subunit” got maximum 1560 citations. Kelley, A. C. Was the most collaborative author and Europe was the most dominant continent collaborating with 132 papers whereas the United States was the top collaborated country with 100 (60.61%) papers. In the context of authorship pattern Triple authored papers were dominated with 34 (20.61%) papers. Among the most funding Sponsored body Agouron Institute topped the list with 23 (13.94%) papers, on the other hand, The Medical Research Council Laboratory of Molecular Biology, United Kingdom was the most contributed affiliation with 91 (55.15%) papers. In term of most preferred source and the most preferred subject of publications were *Science* with 23 (13.94%) and Biochemistry, Genetics and Molecular Biology with 97 (58.79%) papers respectively.

Keywords: Scopus, authorship pattern, Scientometric, Citation, affiliation etc.

Introduction

Novel Laureate Venkatraman Ramakrishna is the Indian-born physicist and molecular biologist who was awarded the 2009 Nobel Prize for Chemistry, along with American biophysicist and biochemist Thomas Steitz and Israeli protein crystallographer Ada Yonath, for his research into the atomic structure and function of cellular particles called ribosomes. (Ribosomes are tiny particles made up of RNA and proteins that specialize in protein synthesis and are found free or bound to the endoplasmic reticulum within cells). He currently works at the MRC Laboratory of Molecular Biology in Cambridge, England.

He was born in 1952 at Chidambaram in Cuddalore district of Tamil Nadu, India. Ramakrishnan held dual citizenship in the United States and Great Britain. In 1971 Ramakrishnan earned a bachelor's degree in physics from Baroda University in Gujarat, India, and in 1976 he received a doctoral degree in physics from Ohio University in the United States. From 1976 to 1978 he took classes as a graduate student in biology at the University of California, San Diego, and worked with Mexican American biochemist

Mauricio Montal, studying a molecule called rhodopsin, which forms channels in cell membranes. Thus, although Ramakrishnan's initial academic background prepared him for a career in theoretical physics, his interests later shifted toward molecular biology. He conducted his postdoctoral research from 1978 to 1982 at Yale University in New Haven, Connecticut. At Yale, he worked in the laboratory of American molecular biophysicist and biochemist Peter Moore and learned to use a technique known as neutron scattering to investigate the structure of the small subunit of ribosomes in the bacterium *Escherichia coli* (ribosomes are composed of two distinct subunits, one large and one small).

From 1983 to 1995 Ramakrishnan was a biophysicist at Brookhaven National Laboratory in New York. There he continued to utilize neutron scattering, as well as another technique called X-ray crystallography, to elucidate the structure of ribosomes and other molecules, including chromatin and proteins known as histones. In 1999 Ramakrishnan took a position in the Medical Research Council Laboratory of Molecular Biology at the University of Cambridge in England. The following year he published a series of groundbreaking scientific papers in which he presented data on the RNA structure and organization of the small ribosomal subunit of *Thermus thermophilus* (a bacterium that is commonly used in genetics research) and revealed the structures of antibiotics bound to small subunits of ribosomes at a resolution of just 3 angstroms (Å; 1 Å is equivalent to 10⁻¹⁰ metre, or 0.1 nanometre).

Ramakrishnan was elected a member of the U.S. National Academy of Sciences in 2004 and a foreign member of the Indian National Science Academy in 2008. He was made a fellow of the Royal Society of London in 2003 and later became the society's first Indian-born president (2015–). Ramakrishnan received the Louis-Jeantet Prize for Medicine in 2007 and the Heatley Medal, awarded by the British Biochemical Society, in 2008. He has been honoured with the second-highest civilian award of India, the Padma Vibhushan in 2010. He was included in the United Kingdom's New Year Honours List for 2012 as a knight bachelor.

(<https://www.britannica.com/biography/Venkatraman-Ramakrishnan> accessed on 27/6/2019)

Literature Review

The Literature review is the major part of the research, which gives an idea about the previous studies and insights towards the possibilities of the present study. Some preferred literature reviewed for the present study is presented as follows:

Kalyane & Kalyane (1993) did Scientometric portrait of Vinodini reddy. Kalyane & Kalyane (1994) carried out a Scientometric portrait of M. S. Swaminathan where 254 research publications were analysed by year, domain, journal-title and collaboration pattern. Kademani, Kalyane & Balakrishnan (1994) did Scientometric portrait of P. K. Iyengar where publications were analysed by year, domain, collaboration pattern and channel of communications and keywords etc. Kademani, Kalyane & Kademani (1994) analysed Scientometric portrait of Nobel Laureate Dr. C. V. Raman objective of the research were to highlight quantitative aspects of the research communications by authorship pattern, domain wise contribution, author productivity, use of channel of communication and documentation of keywords from titles. Kalyane (1995) Research productivity of P. M. Bhargava, the

modern biologist were Quantitatively analysed based on year, domain, collaboration pattern, the channel of communication, number of pages, number of words and keywords in the title in Scientometric portrait of P. M. Bhargava. Kalyane & Kademani (1995) Publication of R. Chidambaram, the well known nuclear physicist have been analysed by year, domain, collaboration pattern, the channel of communication used and keywords etc. In Scientometric portrait R. Chidambaram: a publication productivity analysis. Kalyane & Munnolli (1995) Carried out Scientometric Portrait of T. S west where Research productivity and collaboration pattern were analysed by years, papers, authorship and author wise productivity. Kademani, Kalyane & Kademani (1996) K. S. Krishnan, the well known Indian physicist's research publications were analysed quantitative aspects of research communications by authorship pattern, domain wise contribution, author productivity, use of channels of communication, citation behaviour and documentation of keywords from the titles in Scientometric portrait of sir K. S. Krishnan. Kademani, Kalyane & Kademani (1996) S. Chandrasekhar, the well-known physicist's publications were analysed by year, domain, collaboration pattern, the channel of communications used and keywords etc. Kalyane & Sen (1996) did Scientometric Portrait of Nobel laureate Pierre-Gilles De Gennes analysing 422 papers during 1956 to 1995. Kalyane & Kademani (1997) carried out Scientometric portrait of Barbara McClintock: the Nobel laureate in physiology. Kademani & Kalyane (1998) analysed Scientometric portrait of R. Chidambaram, the Indian nuclear physicist based on citation analysis to identify the extent of citation received to the publications of Dr Chidambaram and the categories of documents citing them, to find out year-wise break up of citations, to examine the citation pattern concerning the status of authorship of the cited articles, to identify the domains of specialization of Dr Chidambaram and to find out the extent of citations to the contributions in each domain, to ascertain the characteristics of citing documents and to compile a ranked list of citing journals, to examine the scattering of citations among journals and to estimate the Bradford multiplier, to draw Bradford-Zipf citograph and to calculate time lag between publication of a paper and it gets its first citation. Kalyane & Sen (1998) did Scientometric portrait of C. R. Bhatia, a geneticist and plant breeder where the year-wise distribution of papers in the various channel of communication, authorship pattern, international collaboration, frequency of distribution of papers and distribution of publications in various domains analysed.

Kademani, Kalyane & Kumar (2000) Scientometric portrait of Vikram Ambalal Sarabhai: a citation analysis reveals the extent of citations received to the publications of Vikram Sarabhai and the types of documents citing them, found out quinquennial citations to the publications, identified top ranking papers, examined the scattering of citations among journals and to estimate the Bradford Multiplier, drawn Bradford-Zipf citograph and identified core peer citing group etc. Kademani, Kalyane & Kumar (2001) examined 246 papers where the productivity coefficient was 0.52. in Scientometric Portrait Of Nobel Laureate Ahmed Hassan Zewail. Kademani, Kalyane & Kumar (2002) carried out A. H. Zewail: Research collaborator par excellence and analysed 246 papers published by Ahmed Hassan Zewail, the Nobel laureate (1999) in chemistry collaborating with 103 colleagues. Kademani, Kalyane & Kumar (2002) Carried out Scientometric portrait of Nobel Laureate Harold W. Kroto which analysed Harold W. Kroto's domain wise contributions, domain wise

authorships, prominent collaborators, the channel of communications used and documentation of keywords from titles of the papers. Munnolli & Kalyane (2003) Scientometric portrait of Ram Gopal Rastogi. Angadi & [et al.] (2004) The bibliographic fields were analysed by normal count procedure for domains, authorships, journals, and keywords in the titles Scientometric Portrait of Nobel Laureate Leland H. Hartwell. Yasmin, M. & Valli, G. (2019) did Scientometric portrait of Prof. Kasi Pitchumani: An organic chemistry catalyst and reveals that 98.2% of papers of total publications were multiples authored.

Objectives

This study highlights Venkatraman Ramakrishnan's research productivity:

- To know the growth of Research
- To find out the most collaborative authors
- To check Authorship pattern
- To ascertain domain wise contributions
- To discover the most preferred source of publications
- To catch out most collaborate affiliation
- To determine most funding sponsors
- To find out the most collaborate Country
- To find out the most cited papers

Methodology

The research publications by Ramakrishnan for this study was extracted from the Scopus database, the world largest abstract and Citation databases lunch in 2004. which covers nearly 36,377 titles (22,794 active titles and 13,583 inactive titles) from approximately 11,678 publishers, of which 34,346 are peer-reviewed journals in a very large subject area. To find out the relevant data for this current research, we made an advanced author ID search (AU-ID: 15733878000) and exported the retrieved data in the CSV file for further evaluation.

In this study, the authors used bibliometric techniques to fulfil the objectives of the research. The bibliometric techniques were used to find out the research productivity of Ramakrishnan. The analysis includes growth of publication, most prolific author, authorship pattern and most preferred journals etc based on objectives of the study.

Results and Discussions

Decade wise Distribution of Publications

The decade-wise distribution of publications shows that the highest number of publications contributed during 2nd and 4th decade with 49 (29.70%) papers each followed by 3rd decade with 38 (23.03%) and 1st decade with 27 (16.36%) respectively.

Table 1: Decade wise Distribution of Publications

Decade	Years	No. of Papers	%
4th	2011-2019	49	29.70
3rd	2001-2010	38	23.03
2nd	1991-2000	49	29.70
1st	1981-1990	27	16.36
	1977-1980	2	1.21
Total		165	100.00

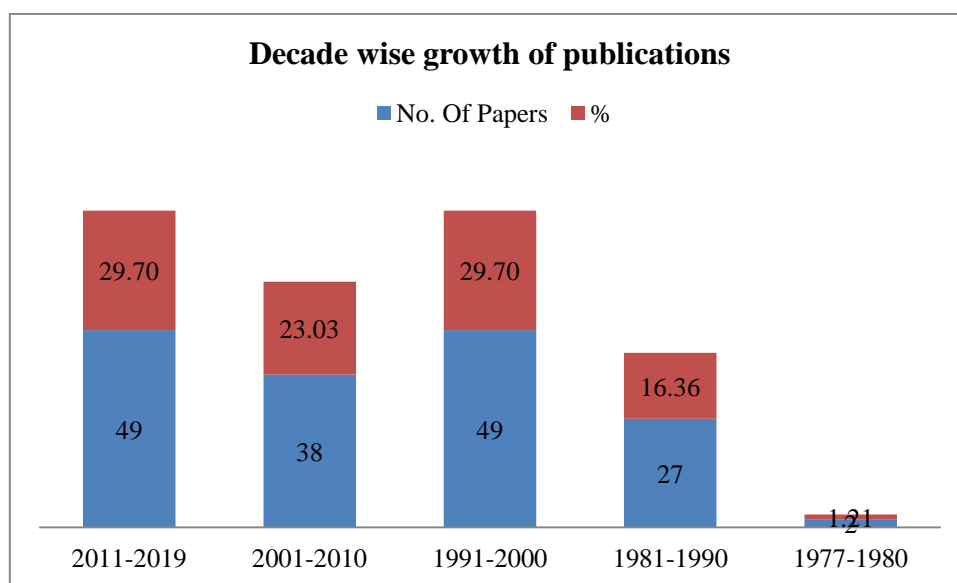


Figure: 1

Top Collaborated authors

Highlighted the top collaborated authors where 10 or more than 10 times collaborated author taken in this table. Author A. C Kelley collaborated in maximum 23 papers with Venkatraman Ramakrishnan followed by S. W. White with 17 papers and S. E. Gerchman with 15 papers respectively.

Table 2: Top Collaborated authors

Rank	Author Name	Affiliation	Country	H-Index	No. of Papers
1	Kelley, A.C.	The Medical Research Council Laboratory of Molecular Biology	United Kingdom	21	23
2	White, S.W.	St. Jude Children's Research Hospital	United States	44	17
3	Gerchman, S.E.	Brookhaven National Laboratory	United States	20	15
4	Wimberly, B.T.	University of Colorado School of Medicine	United States	16	13

5	Brodersen, D.E.	Aarhus Universitet	Denmark	27	12
5	Clemons, W.M.	California Institute of Technology	United States	27	12
6	Brown, A.	Harvard Medical School	United States	27	10
6	Carter, A.P.	The Medical Research Council Laboratory of Molecular Biology	United Kingdom	25	10
6	Graziano, V.	Brookhaven National Laboratory	United States	18	10

Authorship Pattern

Table 3 shows that Author collaboration is an important aspect for the growth of publications where only 10.91 % of papers were the single-authored. Triple authored paper was dominated over five authored papers with 20 (12.12%) and Four authored as well six authored papers with 19 (11.52%) each respectively.

Table 3: Authorship Pattern

No. Of Authors	No. of Papers	Total No. Of Authors	% of Papers
One	18	18	10.91
Two	16	32	9.70
Three	34	102	20.61
Four	19	76	11.52
Five	20	100	12.12
Six	19	114	11.52
Seven	10	70	6.06
Eight	14	112	8.48
Nine	5	45	3.03
Ten	4	40	2.42
Twelve	3	36	1.82
Fifteen	1	15	0.61
Eighteen	1	18	0.61
Twenty Five	1	25	0.61
Total	165	803	100.00

Top Cited Papers

Table focus on top 10 cited papers. Out of 10 top-cited papers, 04 numbers of papers are from *Nature*, 02 numbers of papers are from *Science*, 03 numbers of papers are from *Cell* Journals which are 1st, 3rd and 9th top journals of the world as per google scholar. However top 02 cited papers are from *Nature* with 1560 and 1118 citations followed by 3rd most cited paper is from *Science* with 899 citations received respectively.

Table 4: Top 10 Cited Papers

Rank	Authors	Title	Year	Source title	Cited by
1	Wimberly B.T., Brodersen D.E., Clemons Jr. W.M., Morgan-Warren R.J., Carter A.P., Vornheln C., Hartsch T., Ramakrishnan V.	Structure of the 30S ribosomal subunit	2000	Nature	1560
2	Carter A.P., Clemons W.M., Brodersen D.E., Morgan-Warren R.J., Wimberly B.T., Ramakrishnan V.	Functional insights from the structure of the 30S ribosomal subunit and its interactions with antibiotics	2000	Nature	1118
3	Selmer M., Dunham C.M., Murphy IV F.V., Weixlbaumer A., Petry S., Kelley A.C., Weir J.R., Ramakrishnan V.	Structure of the 70S ribosome complexed with mRNA and tRNA	2006	Science	899
4	Ogle J.M., Brodersen D.E., Clemons W.M. Jr., Tarry M.J., Carter A.P., Ramakrishnan V.	Recognition of cognate transfer RNA by the 30S ribosomal subunit	2001	Science	856
5	Ramakrishnan V., Finch J.T., Graziano V., Lee P.L., Sweet R.M.	Crystal structure of globular domain of histone H5 and its implications for nucleosome binding	1993	Nature	610
6	Brodersen D.E., Clemons Jr. W.M., Carter A.P., Morgan-Warren R.J., Wimberly B.T., Ramakrishnan V.	The structural basis for the action of the antibiotics tetracycline, pactamycin, and hygromycin B, on the 30S ribosomal subunit	2000	Cell	586
7	Ramakrishnan V.	Ribosome structure and the mechanism of translation	2002	Cell	510
8	Ogle J.M., Murphy IV F.V., Tarry M.J., Ramakrishnan V.	Selection of tRNA by the ribosome requires a transition from an open to a closed form	2002	Cell	461

9	Schmeing T.M., Ramakrishnan V.	What recent ribosome structures have revealed about the mechanism of translation	2009	Nature	408
10	Ogle J.M., Ramakrishnan V.	Structural insights into translational fidelity	2005	Annual Review of Biochemistry	387

Geographical Collaborations

The geographical collaboration of Venkatraman Ramakrishnan was extended to 21 countries and 04 continents. In the context of country United States topped the list with highest 100 (60.61%) collaboration followed by the United Kingdom with 97 (58.79%) and Israel with 09 (5.45%) respectively.

On the other hand in the context of Continent, Europe topped the list with highest 132 (80%) collaboration followed by North America with 105 (63.64%) and Asia with 19 (11.52%) and Australia with only 01 (0.61) respectively.

Table 5: Geographical Collaborations

Sl. No.	Country	No. Of Papers	%	Continent
1	United States	100	60.61	North America 105 (63.64%)
2	Canada	5	3.03	
3	United Kingdom	97	58.79	Europe 132 (80%)
4	Sweden	8	4.85	
5	Germany	5	3.03	
6	Belgium	4	2.42	
7	France	4	2.42	
8	Denmark	3	1.82	
9	Poland	3	1.82	
10	Switzerland	3	1.82	
11	Spain	2	1.21	
12	Hungary	1	0.61	
13	Italy	1	0.61	
14	Russian Federation	1	0.61	
15	Israel	9	5.45	
16	Japan	3	1.82	
17	Malaysia	3	1.82	
18	China	2	1.21	
19	India	1	0.61	
20	Singapore	1	0.61	

21	Australia	1	0.61	Australia 1 (0.61%)
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Funding Sponsor Bodies

This table shows the funding sponsored body for the research. In this context, Agouron Institute topped the list with highest 23 (13.94%) followed by National Institute of Health 20 (12.12%) and Wellcome Trust 18 (10.91%) research respectively. Here the most important things are the top two sponsored funding body are from the United States and 3rd one is from the United Kingdom.

Table 6: Top 10 Funding Sponsor Bodies

Rank	Funding Sponsor	Country	Year of Establishment	No. of Papers	%
1	Agouron Institute	United States	1978	23	13.94
2	National Institutes of Health	United States	1887	20	12.12
3	Wellcome Trust	United Kingdom	1936	18	10.91
4	Research Councils UK	United Kingdom	2002	13	7.88
5	Louis-Jeantet Foundation	Switzerland	1982	10	6.06
6	Medical Research Council (MRC)	United Kingdom	1913	9	5.45
6	National Science Foundation	United States	1950	9	5.45
7	National Institutes of Health (NIH)	United States	1887	7	4.24
8	Brookhaven National Laboratory	United States	1947	6	3.64
9	European Synchrotron Radiation Facility (ESRF)	France	1994	5	3.03
10	Foundation for the National Institutes of Health (FNIH)	United States	1990	4	2.42
10	U.S. Department of Energy	United States	1977	4	2.42

Distribution of Publications by Affiliations

Table Explore the distribution of research publications among top 10 affiliations where The Medical Research Council Laboratory of Molecular Biology, United Kingdom topped the list having contributed highest 91 (55.15%) papers followed by Brookhaven National Laboratory, the United States with 38 (23.03%) and University of Utah, School of Medicine, the United States with 26 (15.76%) papers respectively.

On the other hand, out of the top 10 affiliations ranked 1st and 5th affiliation are from the United Kingdom, ranked 8th is from Israel and remaining are from the United States.

Table 7: Distribution of Publications by Affiliations

Rank	Affiliations	Country	No. Of Papers	%
1	The Medical Research Council Laboratory of Molecular Biology	United Kingdom	91	55.15
2	Brookhaven National Laboratory	United States	38	23.03
3	University of Utah, School of Medicine	United States	26	15.76
4	University of Utah	United States	17	10.30
5	Medical Research Council	United Kingdom	15	9.09
6	Yale University	United States	13	7.88
7	Howard Hughes Medical Institute	United States	10	6.06
8	Weizmann Institute of Science Israel	Israel	9	5.45
9	Duke University Medical Center	United States	7	4.24
10	St. Jude Children's Research Hospital	United States	6	3.64

Subject Wise Distribution of Publications

Table 8 presents the distribution of publications by subject which revealed that out of total 165 publications the most preferred subject area of research was “Biochemistry, Genetics and Molecular Biology” with 97 (58.79%) papers followed by Multidisciplinary with 46 (27.88%) and Medicine with 19 (11.52%) papers respectively.

Table 8: Subject Wise Distribution of Publications

Subject Area	No. of Papers	%
Biochemistry, Genetics and Molecular Biology	97	58.79
Multidisciplinary	46	27.88
Medicine	19	11.52
Chemistry	11	6.67
Neuroscience	7	4.24
Immunology and Microbiology	6	3.64
Physics and Astronomy	6	3.64
Engineering	5	3.03
Materials Science	3	1.82
Chemical Engineering	2	1.21
Arts and Humanities	1	0.61
Mathematics	1	0.61

The most preferred source of Publications

Table explores the most preferred source of publications. It was found that journal *Science* was the most preferred source of publications with highest 23 (13.94%) papers followed by *Journal of Molecular Biology* with 15 (9.09%) and *Nature* with 13 (7.88%) papers respectively. However, it was also found that 53.33% of all publications were shared between the top six journals and one proceeding.

Table 9: Top 10 Most Preferred Source of Publications

Rank	Source Title	No.of Papers	%
1	Science	23	13.94
2	Journal Of Molecular Biology	15	9.09
3	Nature	13	7.88
4	Cell	12	7.27
5	Nature Structural And Molecular Biology	9	5.45
6	Biochemistry	8	4.85
6	Proceedings Of The National Academy Of Sciences Of The United States Of America	8	4.85
7	Nobel Lectures Chemistry 2006 2010	7	4.24
8	EMBO Journal	6	3.64
8	Journal Of Biological Chemistry	6	3.64
8	Structure	6	3.64
9	Current Opinion In Structural Biology	4	2.42
10	Acta Crystallographica Section D Biological Crystallography	3	1.82
10	Basic Life Sciences	3	1.82
10	Cold Spring Harbor Symposia On Quantitative Biology	3	1.82

Conclusion

Venkatraman Ramakrishnan has published 165 papers from 1977 to 2019, where 10 or more than 10 collaborations authors were 9 and A. C. Kelly was the most contributed author having highest 23 collaboration. The paper entitled “Structure of the 30s ribosomal subunit” published in *Nature* cited maximum 1560 times. Coming to the geographical distribution of collaboration Europe was the most dominant continent with 132 papers and the United States was the most dominant country with 100 (60.61%) respectively. Agouron Institute, United States was the most funding sponsored body under which sponsorship highest 23 (13.94%) research had been carried out. The Medical Research Council Laboratory of Molecular

Biology, United Kingdom was the most contributed affiliation with highest 91 (55.15%) contributions. Biochemistry, Genetics and Molecular Biology was the most preferred subject area of research with highest 97 (58.79%) papers and *Journal Science* was the most preferred source of publications with 23 (13.94%) papers. Triple authored paper was dominated over five authored papers with 20 (12.12%) and Four authored as well six authored papers with 19 (11.52%) each respectively.

The result of the paper can provide an effective tool to assess the research publication trends of V. Ramakrishnan. The further study can be done by taking the entire Universe of publications by V. Ramakrishnan including publications indexing in Scopus.

References

1. Angadi, M., Koganuramath, M. M., Kademani, B. S., Kalyane, V. L., & Sen, B. K. (2004). Scientometric portrait of Nobel laureate Leland H. Hartwell. *International Workshop on Webometrics, Informetrics and Scientometrics, Roorkee, India, 2-5 March 2004*. [Conference paper]
2. Kademani, B. S., & Kalyane, V. L. (1998). Scientometric portrait of R. Chidambaram: the indian nuclear physicist, based on citation analysis. *Kelpro Bulletin*, 2(1), 13-29.
3. Kademani, B. S., Kalyane, V. L., & Balakrishnan, M. R. (1994). Scientometric portrait of PK Iyengar. *Library Science*, 31(4), 155-176.
4. Kademani, B. S., Kalyane, V. L., & Kademani, A. B. (1994). Scientometric Portrait of Nobel Laureate Dr. CV Raman. *Indian Journal of Information, Library and Society*, 7(3-4), 215-249.
5. Kademani, B. S., Kalyane, V. L., & Kademani, A. B. (1996). Scientometric Portrait of Sir KS Krishnan. *Indian Journal of Information, Library and Society*, 9(1-2), 125-150.
6. Kademani, B. S., Kalyane, V. L., & Kumar, V. (2000). Scientometric portrait of Vikram Ambalal Sarabhai: a citation analysis. *SRELS Journal of Information Management*, 37(2), 107-132.
7. Kademani, B. S., Kalyane, V. L., & Kumar, V. (2001). Scientometric portrait of Nobel laureate Ahmed Hassan Zewail. *Malaysian Journal of Library and Information Science*, 6(2), 53-70.
8. Kademani, B. S., Kalyane, V. L., & Kumar, V. (2002). A. H. Zewail: Research collaborator par excellence. *Scientometrics*, 53(1), 113-121. <https://doi.org/10.1023/A:1014888005151>.
9. Kademani, B., Kalyane, V., & Kademani, A. (1996). Scientometric Portrait of Nobel Laureate S. Chandrasekhar. *JISSI: The International Journal of Scientometrics and Informetrics*, 2(2-3), 119-135.
10. Kademani, B., Kalyane, V., & Kumar, V. (2002). Scientometric portrait of Nobel laureate Harold W. Kroto. *SRELS Journal of Information Management*, 39(4), 409-434. <https://doi.org/10.17821/srels/2002/v39i4/48937>
11. Kalyane, V. (1995). Scientometric Portrait of P. M. Bhargava. *Lucknow Librarian*, 27 (1-4), 42-70.

12. Kalyane, V. L., & Kademani, B. S. (1995). Scientometric portrait of R. Chidambaram: a publication productivity analysis. *Journal of Information Sciences*, 5(3), 101-140.
13. Kalyane, V. L., & Kalyane, S. V. (1993). Scientometric Portrait of Vinodini Reddy. *Journal of Information Sciences*, 4(1), 25-47.
14. Kalyane, V. L., & Munnolli, S. S. (1995). Scientometric portrait of TS West. *Scientometrics*, 33(2), 233-256.
15. Kalyane, V. L., & Sen, B. K. (1998). Scientometric portrait of CR Bhatia, an Indian geneticist and plant breeder. *Malaysian Journal of Library & Information Science*, 3(1), 25-42.
16. Kalyane, V. L., & Sen, B. K. (2017). Scientometric portrait of nobel laureate Pierre-Gilles de Gennes. *Malaysian Journal of Library & Information Science*, 1(2), 13-26.
17. Kalyane, V., & Kademani, B. (1997). Scientometric portrait of Barbara McClintock: the Nobel laureate in physiology. *Kelpro Bulletin*, 1(1), 3-14.
18. Kalyane, V., & Kalyane, S. (1994). Scientometric portrait of M.S. Swaminathan. *Library Science*, 31 (1), 31-46.
19. Munnolli, S., & Kalyane, V. (2003). Scientometric portrait of Ram Gopal Rastogi. *Annals of Library and Information Studies*, 50(1), 1-17.
20. Yasmin, M., & Valli, G. (2019). Scientometric Portrait of Prof. Kasi. Pitchumani: An organic chemistry catalyst. *Library Philosophy and Practice(e-journal)*.<https://digitalcommons.unl.edu/libphilprac/2377>

Web Reference

1. <https://en.wikipedia.org/wiki/Scopus>
2. <https://www.britannica.com/biography/Venkatraman-Ramakrishnan> (accessed on 27/6/2019)