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Mapping of Nephrology Research Performance of Global Scientists in Science Citation Index Expanded

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Abstract

This paper has made an attempt to highlight the Neurology research in global level as per the scientific publications appeared in the Web of Science citation database during the period 2006-2015. It found a total of 23, 335 publications were published by the global researchers in the field of Neurology. The average number of publications published was 2333.5 and the highest numbers of publications (3357) were published in the year 2015. This paper tried to analyze the broad features of literature on global warming focusing on year wise growth of publications, most prolific authors, highly productive institutes, highly productive countries, language wise distributions of publications, high productive subject areas and most preferred journals for publications by scientists were also discussed.

Keywords: Scientometrics, Neurology, annual growth rate, relative growth rate and doubling time, CAI, DC.

Introduction

Neurology is a branch of medicine dealing with disorders of the nervous system. Neurology deals with the diagnosis and treatment of all categories of conditions and disease involving the central and peripheral nervous system including their coverings, blood vessels etc. Neurological practice relies heavily on the field of neuroscience, which is the scientific study of the nervous system. Neurology has been at the heart of the Chiropractic profession since its

very beginning. But it is only in recent years that advances in clinical neuroscience have allowed us to understand how our treatments affect the nervous system; and how this effect can help us to restore and preserve good structure and function within the musculoskeletal system.

Scientometric analysis is the quantitative study of a subject growth by using bibliometric indicators and statistical tools and techniques. It throws light on the pattern of growth of individual to the respective subject literature, inter-relationship among different branches of knowledge, productivity, authorship pattern, degree of collaboration, pattern of collection building, and their use. Gradually the Scientometric studies are attaining the status of inter-disciplinary in nature. Scientometric evaluation is a very key component of any research and development activity. One well known productivity indicator is the number of publications produced by the scientists, institutions and countries. Studies like this will provide some insight into the complex dynamics of research activity and enable researchers, scientists, policy makers and science administrators to provide adequate facilities and proper guidance in which direction the researches to be conducted. Hence, such an indispensable technique is used to evaluate the quality and quantity of literature published across disciplines within a particular geographical area. This is clear from the scientometric evidence from 2006 to 2015, that the number of publications in the Web of Science database was increased from 1119 to 3357. Therefore the present study has been undertaken to know the growth and development of publications in the field of Neurology. It is seen that a few studies have been conducted in the field of Neurology in terms of publications, and citation impact in the past. Braun et al (2006) in their study reported the characteristics of literature productivity, citation patterns, collaborative trends, authorship pattern, and co-authorship trends on Neurology in global level. further, country based research on Neurology have been investigated in China (2003), Europe (2002), Italy (2005), Spain (1990), Sweden (2003), Cuba (2008) by different information scientists, and scholars by different period of time. Further, Velmurugan and Radhakrishnan (2015) analyzed on the research productivity of Indian in the field of Amylase in Microbiology, Velmurugan and Radhakrishnan (2016) examined the impact of research productivity on Nanotechnology in India; Velmurugan (2017) investigated the Bibliometric Law of Fossil Fuel Literature in Science Citation Index Expanded; Velmurugan (2018) conducted a study on Nephrology research performance of Indian Scientists in Science Citation Index Expanded and in the same year Velmurugan (2018) reported the scholarly communications of Nephrology by Indian Scientists as per the data on the Web of Science- Science Citation Index Expanded and Velmurugan (2018) analyzed twenty six year analysis of Fossil Fuel associated with highly cited works. Santha kumar (2016) examined the publications trends in Nuclear Physics in Global level and Santha kumar (2016) studied in Medical Physics in Global perspective.

Objectives for the Study

The main objective of this study is to analyse the global research performance in the field of neurology as reflected in the publication output during 2006-2015. In particular, the study focuses on the following aspects:

- To study the year wise growth of publications
- To study the most prolific authors
- To study the highly productive countries

- To study the highly productive institutes
- To study the language-wise distribution of publications
- To study the most preferred source titles for publication in the field and
- To study the high productive subject areas

Materials and Methods

The Web of Science database was used for retrieving data on neurology in topic field. A total of 23335 publications were downloaded and analyzed by using the Microsoft excels per the objectives of the study. The Web of Science database allows us to refine the results in terms of publication years, countries, institutes, authors, language, subjects and source titles. Only journal articles and review articles were considered for the analysis. to evaluate the appropriate research analysis various scientometirc indices such as Relative Growth Rate (RGR), Doubling Time (DT), Co-Authorship Index (CAI) were used.

Analysis and Interpretations

Relative Growth Rate (RGR)

The Relative Growth Rate (RGR) is the increase in number of articles or pages per unit of time. This definition derived from the definition of relative growth rates in the study of growth analysis in the field of global warming. The mean relative growth rate (R) over the specific period of interval can be calculated from the following equation.

Relative Growth Rate (RGR)

$$1 - 2R = \text{Log } W_2 - \text{Log } W_1 / T_2 - T_1$$

Whereas

$1\text{-}2^{R}$- mean relative growth rate over the specific period of interval
$\text{Log}_e W_1$ - log of initial number of articles
$\text{Log}_e W_2$ - log of final number of articles after a specific period of interval
$T_2\text{-}T_1$- the unit difference between the initial time and the final time

The year can be taken here as the unit of time. The RGR for articles is hereby calculated.

Therefore

$1\text{-}2^{\overline{R}}$ (aa^{-1} $year^{-1}$) can represent the mean relative growth rate per unit of articles per unit of year over a specific period of interval.

$$1\text{-}2^{\overline{R}} = \text{Log}_e W_2 - \text{Log}_e W_1 / T_2 - T_1$$

$$2007 \Rightarrow = \text{Log}_e 1046 - \text{Log}_e 495 / 2007\text{-}2006$$

$$= 6.95 - 6.20/1 = 0.75$$

$2008 \Rightarrow \text{Log}_e\ 1791 - \text{Log}_e\ 1046 / 2008\text{-}2007$

$= 7.49 - 6.95/1 = 0.54$

Doubling Time (DT)

There exists a direct equivalence between the relative growth rate and the doubling time. If the number of articles or pages of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be logarithm of the number 2. If natural logarithm is used this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula.

$$\text{Doubling Time (DT)} = 0.693/R$$

Therefore,

Doubling time for articles Dt (a)= $0.693/1\text{-}2^{\overline{R}}$ (aa^{-1} $year^{-1}$)

$2007 \Rightarrow 0.693/0.75 = 0.92$

$2008 \Rightarrow 0.693/0.54 = 1.28$

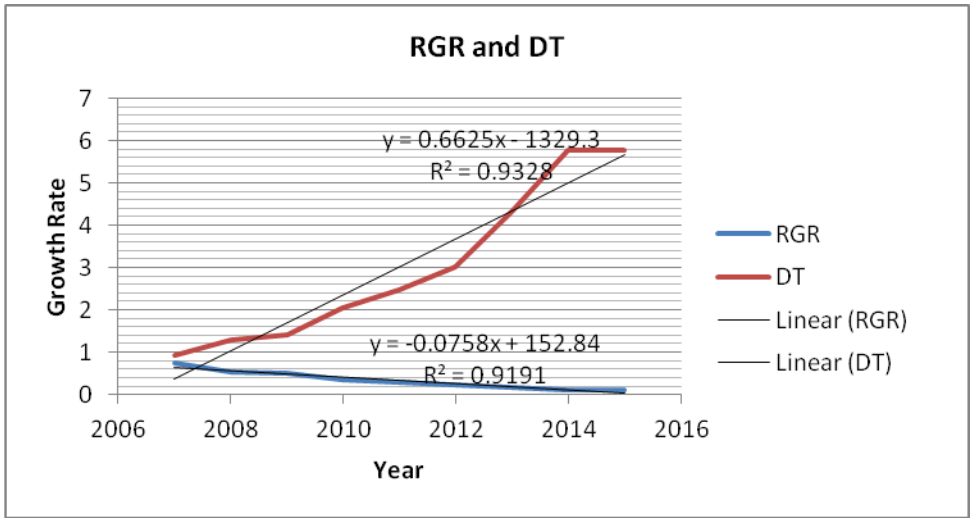
Table 2 Relative growth rate (RGR) and Doubling time (DT) of publications

Year	No. of Publications	Cumulative Total	W1	W2	RGR	DT
2006	491	495	-	6.20	-	-
2007	555	1046	6.20	6.95	0.75	0.92
2008	745	1791	6.95	7.49	0.54	1.28
2009	1141	2932	7.49	7.98	0.49	1.41
2010	1172	4104	7.98	8.32	0.34	2.04
2011	1325	5429	8.32	8.60	0.28	2.48
2012	1421	6850	8.60	8.83	0.23	3.01
2013	1178	8028	8.83	8.99	0.16	4.33
2014	981	9009	8.99	9.11	0.12	5.78
2015	1158	10167	9.11	9.23	0.12	5.78

A total of 10167 publications were published during 2006-2015. The average number of publications per year was 1017. There were only 1119 publications in 2006 and a continuous growth of publications was observed during the study period. The highest publications (3357) were in 2015. It was observed that there was a steady growth of publications during 2006-2015.

The year wise RGR is found to be in the range of 0.82 to 0.16. It has been observed from Table 2 and figure 2 that RGR is downward trend from 2007 (0.82) to 2015 (0.16). The doubling time (DT) was upward trend from 2007 (0.85) to 2015 (4.33).

Figure 1 Relative growth rate for research output



Identification of most prolific authors

The authors having 25 or more publications during 2006-2015 are given in Table 3. Anonymous is the most productive author with 116 (1.14%) publications followed by Okumura, A with 42 (0.41%) publications, Petersen, R. C 39 (0.38%) publications, Knopman, D. S with 35 (0.34%) publications, Sasaki, M with 35 (0.34%) publications, Boeve, B. F with 34 (0.33%) publications, Saito, Y with 32 (0.32%) publications and Jack, C. R with 32 (0.32%) publications respectively. And a total of 41,077 authors are contributed entire research output of the period under study.

Table 3 Identification of most prolific authors

Rank	Author	No. of publications	Percentage
1	Anonymous	116	1.14%
2	Okumura A	42	0.41%
3	Petersen R C	39	0.38%
4	Knopman D S	35	0.34%
5	Sasaki M	35	0.34%
6	Boeve B F	34	0.33%
7	Saito Y	32	0.32%
8	Jack C R	31	0.31%
8	Sugai K	29	0.29%
10	Barkhof F	28	0.28%
11	Demaerschalk B M	25	0.25%
12	Yamamoto T	25	0.25%

Authorship Pattern of Publications

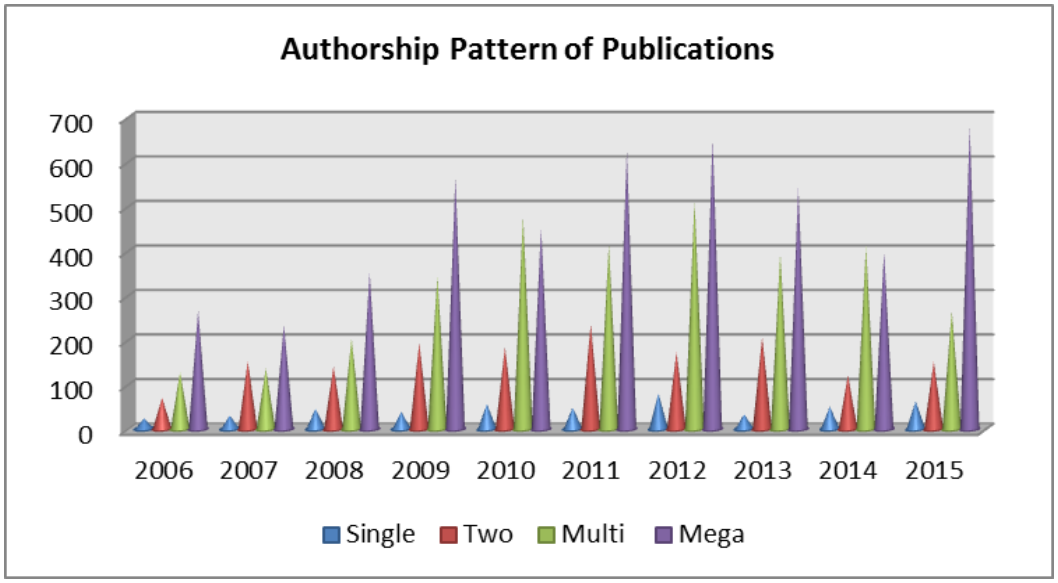
The authorship pattern was analysed to determine the percentage of single and multiple authors. From the table 4, it is observed that out of 10167 publications, maximum of 4766 (46.88%) publications have been contributed by mega authors, followed by multi authors with 3289 (32.35%) publications, two authors with 1635 (16.08%) publications. Only 477 (4.69%) publications have been contributed by single authors. It indicates that the multi authored works are more than that of single authored contributions in the medical field of neurology.

Table 3 Authorship pattern of publications

Block	Year	Single	CAI	Two	CAI	Multi (3&4)	CAI	Mega	CAI	Total	CC
1	2006	25	105	71	80	129	83	266	119	491	0.65
	2007	31	117	153	152	137	78	234	93	555	0.61
	2008	47	130	142	105	204	87	352	104	745	0.63
	2009	39	70	194	94	343	95	565	109	1141	0.66
	2010	57	100	184	87	479	130	452	85	1172	0.63
Total		199		744		1292		1869		4104	0.64
2	2011	49	81	237	113	414	95	625	99	1325	0.64
	2012	81	124	174	83	513	110	653	96	1421	0.65
	2013	34	63	207	120	395	102	542	96	1178	0.65
	2014	51	113	121	84	411	127	398	85	981	0.65
	2015	63	119	152	89	264	69	679	123	1158	0.65
Total		**278**		**891**		**1997**		**2897**		**6063**	**0.65**

CAI–Co -Authorship Index, CC–Collaboration Coefficient

Figure 2 Authorship pattern of publications



Pattern of Co-Authorship Index (CAI)

In order to examine how the pattern of Co-Authorship Index (CAI) has changed during the study period, the following formula of Co-authorship Index suggested by Garg and Padhi was used.

$$CAI = \{(Nij / Nio) / (Noj/Noo)\} \times 100$$

Nij - Number of papers having j authors in block i
Nio - Total output of block i
Noj - Number of papers having j authors for all blocks
Noo - Total number of papers for all authors and all blocks
J = 1, 2, 3……..n

CAI = 100

CAI = 100 implies that co-authorship in a particular block for a particular type of authorship corresponds to the world average, CAI> 100 reflects higher than average co-authorship effort and CAI<100 lower than average co-authorship effort in a particular block for a particular type of authorship.

For calculating the co-authorship index and collaboration coefficient for authors, countries have been replaced by block. For this study, the authors have been classified into two blocks, vz Single, Two, Multi and Mega authors and the results of Co-authorship index and collaboration coefficient have been presented in the Table 3. The study reveals that the result of co-authorship index and it is observed that the value of CAI for multi authored papers is the highest and for single authored papers was lowest, which indicated that the collaborative research is increasing in the field of neurology**.** With regard to the multi authored publications with more than two authors, the co-authorship has shown fluctuation trend in the two blocks year periods. This implies that the collaborative pattern in neurology research is mainly characterized by co-authored papers not by single authored papers.

The average value of collaboration coefficient for neurology is 0.65. The highest value of collaboration coefficient is 0.66 in 2009 and the lowest value is 0.61 in 2007. However, the value of collaboration coefficient is showing increasing and decreasing trend in the two blocks year periods.

Comparative Study of Single Author vs Multiple Authors

Table 4 presents the single and multiple-authors productivity pattern on yearly basis. There were 9690 (95.31%) multi authored and only 477 (4.69%) single authored publications. The productivity patterns on the neurology publications are much contributed by the multiple authors than the single author since 2006 to 2015.

Table 4 Single author vs multiple authors

Year	Single author		Multiple authors		Quantum of research output	Collaboration rate
	Quantum of output	Percentage	Quantum of Output	Percentage		
2006	25	0.25	466	4.58	491	0.95
2007	31	0.30	524	5.15	555	0.94
2008	47	0.46	698	6.87	745	0.94
2009	39	0.38	1102	10.84	1141	0.97
2010	57	0.56	1115	10.97	1172	0.95
2011	49	0.48	1276	12.55	1325	0.96
2012	81	0.80	1340	13.18	1421	0.94
2013	34	0.33	1144	11.25	1178	0.97
2014	51	0.50	930	9.15	981	0.95
2015	63	0.62	1095	10.77	1158	0.95
Total	477	4.69	9690	95.31	10167	0.95

Highly productive institutes

Table 4 presents the institutions that have contributed more than 100 publications during 2006-2015. There were 9257 global institutions involved in the Neurology research. Among these top 11 institutions 9 are from USA and each one from UK and Canada. Mayo Clinic, USA topped the list with 288 (2.83%) publications followed by Harvard University, USA with 245 (2.41%) publications, University of California San Francisco, USA with 182 (1.79%) publications, UCL Institute of Neurology, UK with 162 (1.59%) publications, University of California Los Angeles, USA with 147 (1.45%) publications, University of Pennsylvania, USA with 144 (1.42%) publications, University of Toronto, Canada with 133 (1.31%) publications and Columbia University, USA with 127 (1.10%) publications.

Table 4 Highly productive institutes

Rank	Institutions	Country	No. of Publications
1	Mayo Clinic	USA	288 (2.83%)
2	Harvard University	USA	245 (2.41%)
3	University of California San Francisco	USA	182 (1.79%)
4	UCL Institute of Neurology	UK	162 (1.59%)
5	University of California Los Angeles	USA	147 (1.45%)
6	University of Pennsylvania	USA	144 (1.42%)
7	University of Toronto	Canada	133 (1.31%)
8	Columbia University	USA	127 (1.25%)
9	Massachusetts General Hospital	USA	126 (1.24%)
10	Johns Hopkins University	USA	117 (1.15%)
11	Washington University	USA	112 (1.10%)

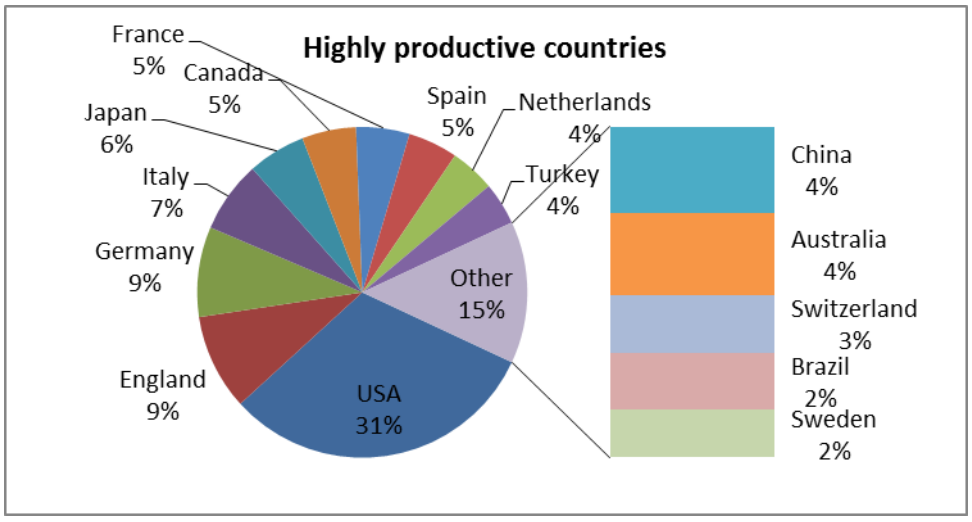
Highly productive countries

Table 5 gives highly productivity countries ((≥200 publications) in Neurology research. In all there were 95 countries that have at least one publication in the research field of Neurology. USA topped the list with highest share 3151 (30.99%) of publications. England ranked second with 945 (9.30%) share of publications followed by Germany 888 (8.73%) share of publications, Italy with 706 (6.94%) share of publications, Japan with 570 (5.61%) share of publications, Canada with 535 (5.26%) share of publications, France with 527 (5.18%) share of publications, Spain with 490 (4.82%) share of publications, Netherlands with 443 (4.36%) share of publications and Turkey with 419 (4.12%) share of publications.

Table 5 Highly productive countries

Rank	Country	Total Publications (%)	Rank	Country	Total Publications (%)
1	USA	3151 (30.99%)	9	Netherlands	443 (4.36%)
2	England	945 (9.30%)	10	Turkey	419 (4.12%)
3	Germany	888 (8.73%)	11	China	367 (3.61%)
4	Italy	706 (6.94%)	12	Australia	347 (3.41%)
5	Japan	570 (5.61%)	13	Switzerland	244 (2.40%)
6	Canada	535 (5.26%)	14	Brazil	241 (2.37%)
7	France	527 (5.18%)	15	Sweden	201 (1.98%)
8	Spain	490 (4.82%)			

Figure 4 Highly productive countries



Most preferred source titles

Table 6 provides the leading journals each with number of publications and impact factor. The scientific literature on neurology is spread over 3297 different web of science source journals. It

reveals that Neurology the list with the highest number of publications 2284 (22.47%) and the impact factor is 8.286, followed by European Journal of Pediatric Neurology with a share of 751 (7.39%) publications and the impact factor is 2.20. Brain Development occupies the third position with 651 (6.40%) publications and the impact factor is 1.785. The fourth highest source title is Revista De Neurologia with 172 (1.69%) publications and the impact factor is 0.684, Journal of Child Neurology with 106 (1.04%) publications and the impact factor is 1.385 and Neurologia with 94 (0.93%) publications and the impact factor is 1.79.

Table 6 Source Title of Publications

Rank	Source Title	No. of Publications	Percentage	Impact Factor
1	Neurology	2284	22.47	8.286
2	European Journal of Pediatric Neurology	751	7.39	2.20
3	Brain Development	651	6.40	1.785
4	Revista De Neurologia	172	1.69	0.684
5	Journal of Child Neurology	106	1.04	1.385
6	Neurologia	94	0.93	1.79
7	Neural Regeneration Research	87	0.86	1.24
8	Epilepsy Behavior	85	0.84	2.061
9	Journal of Neurology	80	0.79	3.578
10	Arquivos De Neuro Psiquiatria	79	0.78	0.843

High productivity subject areas

The scientific literature on neurology is spread over 93 different subjects. Table 7 shows high productivity subjects which are contributing more than 100 articles. It is found that Neurosciences Neurology has highest number of articles with 7216 (70.98%) followed by Pediatrics contributing 1176 (11.57%) articles. Psychiatry occupies the third position with 662 (6.51%) articles. The fourth highest articles belonged to the subject General Internal Medicine with 607 (5.97%), Surgery with 300 (2.95%) and Cardiovascular System Cardiology with 279 (2.74%) articles respectively.

Table 7 High productivity subject areas

Rank	Subject	No. of Articles	Percentage
1	Neurosciences Neurology	7216	70.98
2	Pediatrics	1176	11.57
3	Psychiatry	662	6.51
4	General Internal Medicine	607	5.97
5	Surgery	300	2.95
6	Cardiovascular System Cardiology	279	2.74
7	Psychology	179	1.76
8	Pharmacology Pharmacy	174	1.71

9	Health care Sciences services	165	1.62
10	Radiology Nuclear Medicine Medical Imaging	163	1.60

Conclusion

The present study attempted to highlight the growth and development of research publication on global warming. A total of 23335 publications were published during 2006-2015 and the average number of publication per year was 2333.5. There was a steady growth of publication during the study period. USA topped the list with highest share (33.89%) of publications followed by China with 12.59% share of publications, England with 10.21% share of publications and Germany with 9.14% share of publications. Chinese Academy of Science, China topped the list with 1298 (5.56%) publications followed by National Oceanic and Atmospheric Administration, USA with 424 (1.82%) publications, National Centre for Atmospheric Research, USA with 350 (1.50%) publications, and Columbia University, USA with 337 (1.44%) publications. The most prolific authors, high productive subjects and also the most preferred journals with impact factor which they publish have also been identified.

Reference

1. Berardelli A, Defazio G, Mancardi GL, Messina C. (2004). Neurological research in Italy in 2003 and 2004. Neurol Sci, 26, 189-93.

2. Braun T, Glanzel W, Schubert A. (2001). Publication and cooperation patterns of authors of neuroscience journals. Scientometrics, 51, 499-510.

3. Dorta-Contreras AJ, Arencibia-Jorge R, Marti-Lahera Y, Araujo-Ruiz JA. (2008). Productivity and visibility of Cuban neuroscientists: Bibliometric study of the period, 2001-2005. Revista de Neurological, 47, 355-60.

4. Glanzel W, Danell R, Person O. (2003). The decline of Swedish neurosciences: Decomposing a bibliometric national science indicators. Scientometrics, 57, 197-213.

5. Gomez I, Sanz E, Mendez A. (1990). Utility of bibliometric analysis for research policy: A case study of Spanish research in neurosciences. Res Policy, 19, 457-66.

6. Lopez-Munoz F, Marin F, Boya J. (1996). Bibliometric evaluation of the Spanish scientific output in neurosciences: Analysis of the publication with international readership between 1984 and 1993. Revista de Neurologica, 24, 417-26.

7. Mela GS, Mancardi GL. (2002). Neurological research in Europe, as assessed with a four-year overview of neurological science international journals. J Neurol, 249, 390-5.

8. Robert C, Wilson CS, Gaudy J, Arreto C. (2006). A snapshot of EU publications in sleep research: A scientometric survey. Scientometrics, 67, 385-405.

9. Santha kumar R. "Publications Trends in Nuclear Physics: A Global Perspective" (2016). *Library Philosophy and Practice (e-journal).* Paper 1361. http://digitalcommons.unl.edu/libphilprac/1361

10. Santha kumar R. Research Trends in Medical Physics: A Global Perspective" (2016). *Library Philosophy and Practice (e-journal).* Paper 1362. http://digitalcommons.unl.edu/libphilprac/1362

11. Velmurugan, C and Radhakrishnan, N. (2015). Research Productivity of Amylase in Microbiology in Indian Perspective: a Scientometric analysis, Microbial Production of Amylase in Bacillus Cereus Sp, Edited by Manimaran, D, Velmurugan, C and Elangovan, N, Dr, Germany, LAMBERT Academic Publishing (LAP), pages-128-143.

12. Velmurugan, C. & Radhakrishnan, N. (2016). Impact of Research productivity on Nanotechnology in India: A Scientometric Profile. International Journal of Multidisciplinary Papers, (1), 1-10.

13. Velmurugan, C. (2017). An Application of the Bibliometric Law of Fossil Fuel Literature in Science Citation Index Expanded. Organic and Medicinal Chemistry International Journal, 4(5),1-4.

14. Velmurugan, C. (2018). Nephrology Research Performance of Indian Scientists in Science Citation Index Expanded: A Scientometric Profile. JOJ Urology & Nephrology, 5(2), 1-6.

15. Velmurugan, C. (2018). Scholarly Communications of Nephrology by Indian Scientists in Science Citation Index Expanded: a Scientometric Profile. Library Philosophy and Practice (e-journal). 1716, 1-13. https://digitalcommons.unl.edu/libphilprac/1716

16. Velmurugan, C. (2018). Twenty six year Analysis of Fossil Fuel Related Highly Cited Works: A Web of Science Based Scientometric Profile. International Journal of Environmental Sciences & Natural Resources, 10(5), 1-9.

17. Xu W, Chen Y, Shen, Z. (2003). Neuroscience output of China: A Medline based bibliometric study. Scientometrics, 57, 399-409.