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# Bioinformatics Research in India during 2009-2018: A Scientometric Analysis

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## Abstract

The aim of the present study is to analyze the productivity growth of Bioinformatics research publications in India during the period (2009-2018). The primary data was collected from the Scopus database. The study examine scientific productivity on various scientometrics parameters i.e. year wise growth rate of publications, most productive authors name and their no. of publications, subject wise distribution of publications, source title, significant keywords, affiliations, funding agencies, after the analysis it has been found that the highest number of 348 research papers were published in the year 2018 and Chakraborty, C. was most productive author with 20 contribution and got the first rank. In the field of Biochemistry, genetics and molecular biology, the highest 1269 research papers were published and the highest 98 articles were published in PloS one journal while the most significant keyword was 'Bioinformatics' which was used in 1604 research papers. The most productive organization is the Vellore Institute of technology which has contributed 89 research papers during the period of study. The most popular funding agency was the Council of Scientific and Industrial Research (CSIR) who have funded 144 research papers in bioinformatics subject area in India from the marked period of study.

**Keywords:** Scientometrics, Bibliometrics, Bioinformatics, Scientific Productivity, Annual Growth Rate.

## Introduction

Bioinformatics is an interdisciplinary field principally including atomic science and hereditary qualities, software engineering, arithmetic, and statistics. Information serious, huge scale biological issues are tended to form a computational perspective. "Bioinformatics is an interdisciplinary research area at the interface between computer science and biological science. A variety of definitions exist in the literature and on the World Wide Web; some are more inclusive than others. Here, we adopt the definition proposed by (Luscombe et al.) in defining bioinformatics as a union of biology and informatics: bioinformatics involves the technology that uses computers for storage, retrieval, manipulation, and distribution of information related to biological macromolecules such as DNA, RNA, and proteins. The emphasis here is on the use of computers because most of the tasks in genomic data analysis are highly repetitive or mathematically complex. The use of computers is absolutely indispensable in mining genomes for information gathering and knowledge building. Bioinformatics differs from a related field known as computational biology. Bioinformatics is limited to sequence, structural, and functional analysis of genes and genomes and their corresponding products and is often considered computational molecular biology. However,

computational biology encompasses all biological areas that involve computation. For example, mathematical modelling of ecosystems, population dynamics, application of the game theory in behavioural studies, and phylogenetic construction using fossil records all employ computational tools, but do not necessarily involve biological macromolecules.” (Jin Xiong, 2006).

## **Methodology**

The raw data was collected by the Scopus database which a comprehensive multidisciplinary citation database is indexing a huge number of science and technology journals globally owned by Elsevier. The study aimed to analyse the Bioinformatics research publications during the period of the last one decade i.e. (2009-2018) and to identify: the growth rate of publications; productive authors name; subject area; source title; significant keywords; affiliation name and funding agencies. The following search string was used to collect the raw data i.e. ((TITLE-ABS-KEY ("Bioinformatics") AND AFFILCOUNTRY (India)) AND DOCTYPE (ar) AND PUBYEAR > 2009 AND PUBYEAR < 2018). The raw data has been analysed and tabulated by MS Excel application software.

## **Related study**

Verma and Shukla (2019) investigated a scientometric study on information literacy of selected countries from (2008-2017) in which a total of 9496 records were published index in the Scopus database. The study examined various scientometric parameters and after the analysis, it was found that the maximum (12.99%) of research papers were published in 2016, the maximum annual growth and compound annual growth rate were (25.679%) and 10.212%) recorded in 2010 and 2009 respectively. The relative growth rate was found in decreasing while doubling time shown in increasing trends. The most productive author was Wolf, M.S with 65 publications while the maximum scientists were chosen to publish their research result in Journal so it was found that article type documents were (71.59%).

Shukla (2019) conducted a scientometric study on genetic disorder research in India from the marked period (2008-2017). The Scopus database used for collecting the data. The highest (13.72%) of research papers were published in 2017; the highest annual growth rate was (36.268) recorded in 2012; the highest compound annual growth rate was (9.126%) in 2010; while the highest (65.91%) of documents were related to medicine subject. The maximum (70.38%) of research papers were Article type documents while the most common keyword was Human during the period of study.

Shukla and Verma (2019) carried out a scientometric analysis on digital library research in India during the period of 10 years i.e. (2009-2018). The primary data was collected to use of Scopus database in which a total 1068 research papers were found from the marked period of study. On the observation of data, it has been shown that the maximum publications were published by two authors. The annual growth rate and compound annual growth rate was in the fluctuating trend, while the average degree of collaboration was (0.81). The relative growth rate was shown in decreasing trend while doubling time was shown in the increasing trend. The maximum (45.13%) of publications were conference papers while Digital library (472) keyword was used very frequently.

Amsaveni and HariKrishnan (2018) investigated a scientometric analysis of environmental management research output from the marked period (1989–2014). The primary data was collected from Web of Knowledge, includes, SSCI, SCI, A&HCI databases in which a total of 61877 research papers were found in which the maximum doubling time (Dt) was 99 found in 2001 while the sample means relative growth rate is 0.19. The highest of 930 research papers were published in the Journal of Environmental Management.

Senthilkumar & Muthukrishnan (2017) investigated a scientometric study on British Journal of Cancer publications from (2005-2015) and after the analysis, it was found that the major contribution to articles comes from UK (31.5%) with a global citation score of 54323, the top 20 institutions involved in Cancer research have published with each other 2653 (38.9%) records with mean of 133 contribution per organization, the ‘Cancer’ has been found most common keyword used in 3801 (55.70%) records by the scientist.

Yeshawant and Ravi (2016) conducted a scientometric analysis of Blood Cancer research (2004-2013). The raw data gathered by the PubMed database which is published by NLM. On the observation of data, it has been shown that the highest 89.41% research papers were published by Indian authors, followed by 6.56% of research papers were published by Pakistani authors. The highest of 324 research papers were published in the field of Blood Cancer in 2012, followed by 308 research papers in 2013. The mean of records was produced each year was 173 during the period of study.

Gupta et al (2016) investigated a Lung Cancer research publication in India: A scientometric study from 2005-2014. The SCOPUS database was used to form data collection. After the analysis, it has been found that a total of 3653 research papers were published on lung cancer during the period of study. The mean growth rate was 18.81%, and the maximum 9.23% of publications were coming from the United States, followed by China with 11.19% of contributions. The major contribution to India’s international collaborative output, the maximum 51.69% share came from the United States, the top 15 famous journals together contributed 20.23% to the total journal publications on the subject of lung cancer from the marked period of study.

Jeyshankar and Babu (2013) carried out a scientometric analysis of Leukemia research output from (1960-2011). The SCOPUS database was used to collect the raw data, on the observation of the data it has been found that a total of 2120 records were published on Leukemia research and also found that the large 40.80% of publications were published from 2007-2011. The maximum 0.45 relative growth rate was found during (1972-1976), and the highest 10.57 doubling time was found from (1992-1996). The maximum 79.67% of research papers were published by multiple authors, followed by two authors with 13.92% of publications.

## **Data Analysis**

### **Growth of Bioinformatics Research and Annual Growth Rate of publication**

Figure 1 shows that the year wise growth of bioinformatics research publication in India during the period (2009-2018) in which a total of 2309 research papers were published by Indian scientists. During the period of study, bioinformatics research literature was shown in increasing trends but in the year 2011 and 2017, the publications have been shown in

decreasing trends. The maximum 348 research papers were published in the year 2018, followed by 335 publications in 2016 and the minimum 75 publications were published in the year 2009. The similar scientometric study conducted by (Shukla and Gupta, 2019) on web mining research found that the annual growth rate was in fluctuating trend like the present study. The annual growth rate is a useful method to evaluate the yearly trends in research productivity (Kumar & Kaliyaperumal, 2015).

$$AGR = \frac{EndValue - FirstValue}{FirstValue} \times 100$$

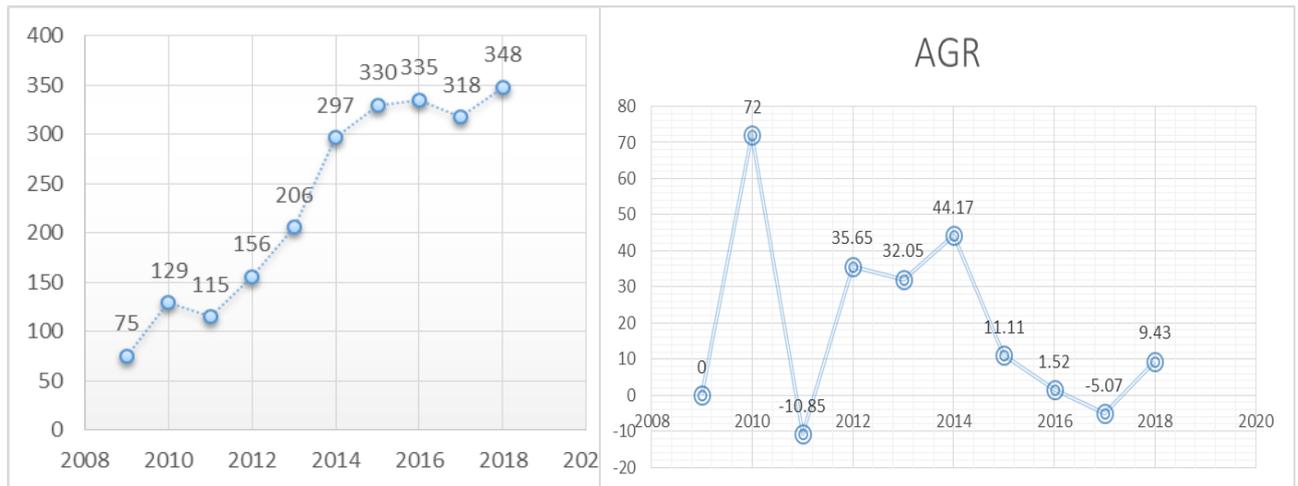


Figure 1: Growth of Bioinformatics Research and Annual Growth Rate of publication

### Authors contributed =>30 papers

Figure 2 illustrates that the authors contributed =>30 research papers in bioinformatics research the maximum 20 research papers were contributed by Chakraborty, C., followed by Arockiaraj, J. and Maulik, U. with 19 publications each. From the marked period of study, it has been also analysed that the maximum 55 publications contributed by five authors followed by 45 publications contributed by three authors and 40 research papers published by four authors.

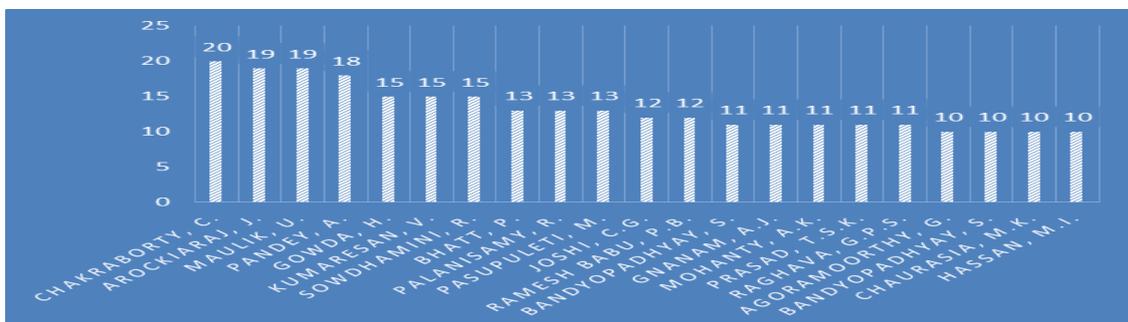


Figure 2: Authors contributed =>30 papers

### Subject Area in Bioinformatics research

Figure 3 depicts that the domain of bioinformatics is very broad and literature published in the domain are scattered. While searching the literature on Scopus, it has been found that a total of 26 subjects in which the bioinformatics research papers were published. The maximum 1269 publications in bioinformatics were published in the domain of biochemistry, genetics and molecular biology subjects, followed by 494 research papers in medicine subject and the minimum 2 research papers were published in dentistry subject.

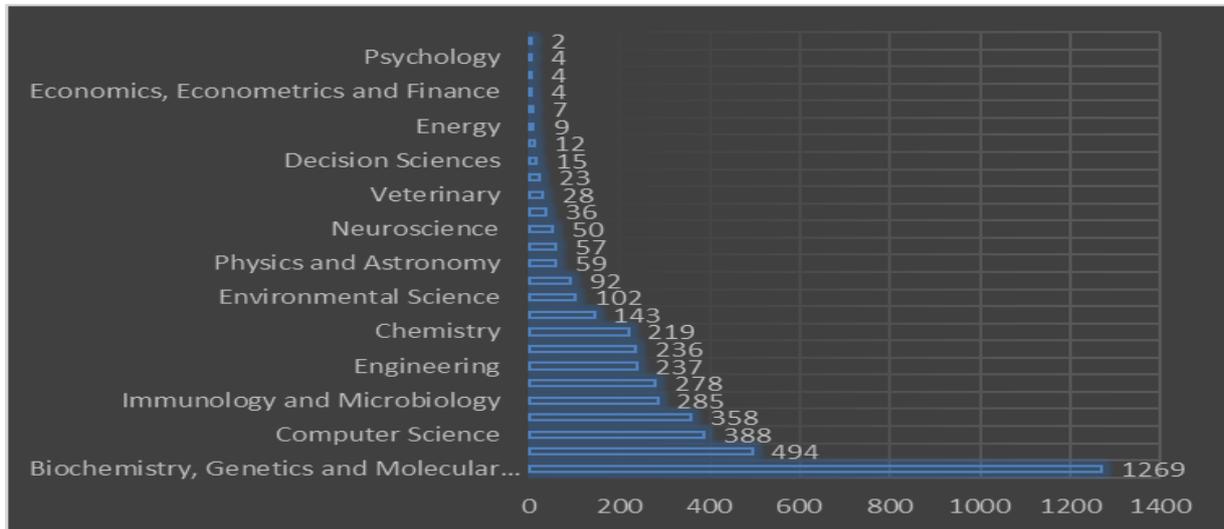


Figure 3: Subject Area

**Source title published =>12 papers**

Figure 4 reveals that the source title published =>12 papers in bioinformatics research from the marked period of study. The maximum 98 research papers were published in Plos (Public Library of Science) one journal, followed by BMC (BioMed Central) bioinformatics and Gene with 32 publications each and 27 research papers were published in the International Journal of Pharmacy and Pharmaceutical Sciences.

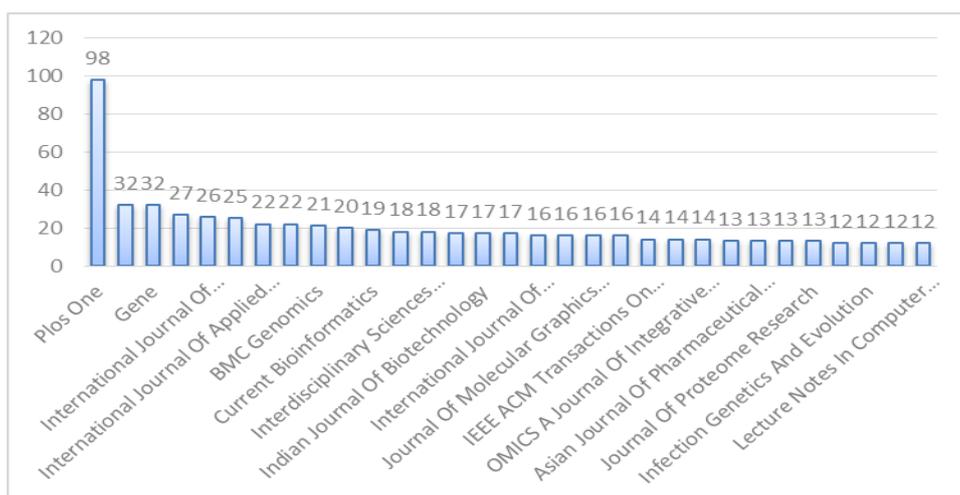


Figure 4: Source title published =>12 papers

**Significant keywords in Bioinformatics research**

Figure 5 shows that the most significant keywords were ‘bioinformatics’ in 1604 research papers in bioinformatics research publications, followed by 1527 publications used ‘article’ keywords and Nonhuman keyword used in 780 publications.

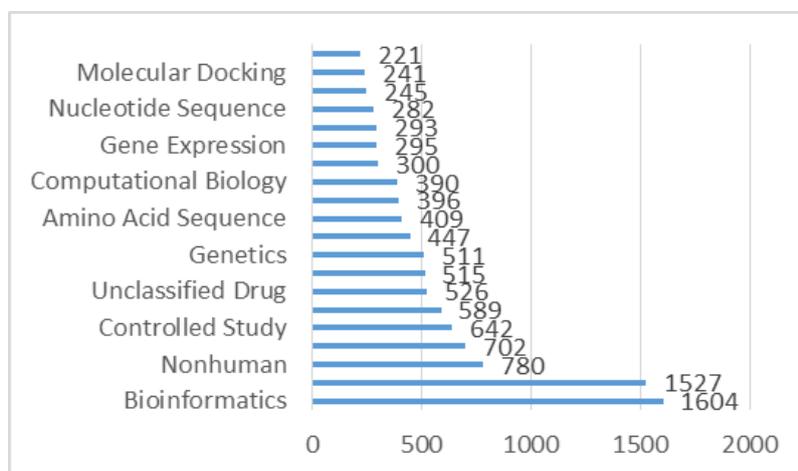


Figure 5: Significant keywords in Bioinformatics research

### Affiliations name (organisations) contributed =>30 publications

Figure 6 illustrates an affiliations name which has contributed =>30 publications in bioinformatics research in India during the period of study. The maximum 89 publications were contributed by Vellore Institute of technology, followed by the council of scientific and industrial research India with 71 publications and 70 research papers were contributed by the Indian Institute of Science, Bangalore.

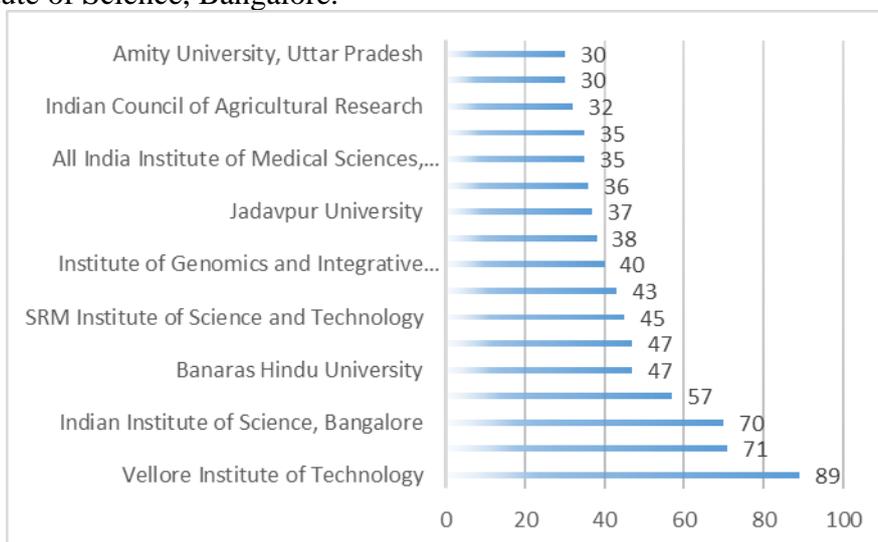


Figure 6: Affiliations name (organisations) contributed =>30 publications

### Funding Agencies

Figure 7 depicts that the maximum 144 bioinformatics research paper’s funding agency was a council of scientific and industrial research (CSIR), followed by 100 publications funded by the department of biotechnology, government or West Bengal (DBT-WB) and department of biotechnology, the ministry of science and technology (DBT) with 95 research papers.

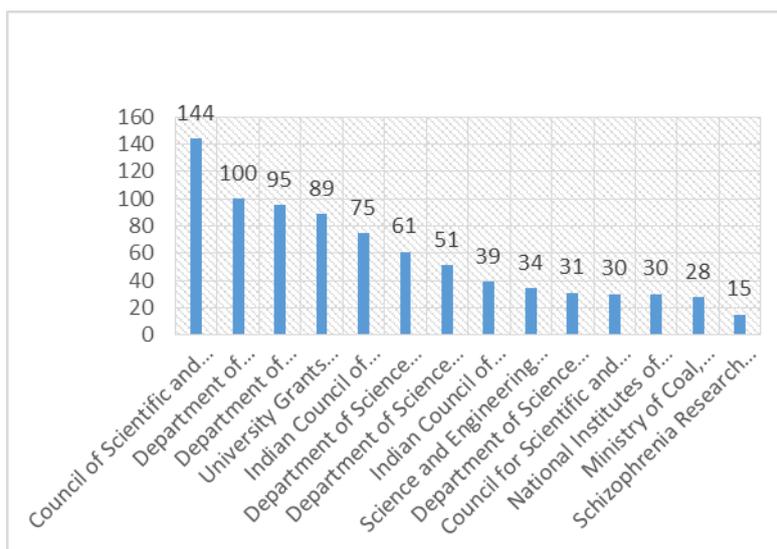


Figure 7: Funding Agencies

## Discussion and Conclusion

The study examined the growth rate of Bioinformatics research publications from the marked period (2009-2018) in which a total of 2309 research papers were published in the different area of Bioinformatics. Out of a total 2309 publications, the huge number of 348 research papers were published in 2018, followed by 335 and 330 publications in the year 2016 and 2015 respectively the growth rate of publications were shown in fluctuating trends from the marked period of study. Chakraborty, C. was the most prolific author with 20 contributions, followed by Arockiaraj, J. and Maulik, U. with 19 each publication. 1269 publications came from Biochemistry, Genetics and Molecular Biology subject area, followed by Medicine and Computer science subject areas with 494 and 388 publications while the highest 98 publications published in Plos One journal, followed by BMC Bioinformatics and Gene with 32 publications each. The most common keyword was Bioinformatics (1604), followed by Article and Nonhuman with 1527 and 780 publications each. Vellore Institute of Technology was contributed maximum 89 publications, followed by Council of Scientific and Industrial Research India and Indian Institute of Science, Bangalore with 71 and 70 publications respectively while the Council of Scientific and Industrial Research (CSIR) funding agency was funded 144 publications, followed by Department of Biotechnology, Government of West Bengal (DBT-WB) and Department of Biotechnology, Ministry of Science and Technology (DBT) funding agencies were funded 100 and 95 publications respectively during the period of study.

## References

- Gupta, R., Ahmed, K. K. M., Gupta, B. M., Bansal, M., & Gupta, B. M. (2016). Lung cancer in India : A scientometric study of publications during 2005 – 14. *International Journal of Medicine and Public Health*, 6(4), 200–208.
- Jeyshankar, R. & Babu, B R. (2011). Scientometric analysis of Leukemia research output (1960-2011): An Indian perspective. *Asia Pacific Journal of Library and Information Science*, 3(2).
- Luscombe, N.M., Greenbaum, D. & Gerstein, M. (2001). What is bioinformatics? A proposed definition and overview of the field. *Method Inform Med*, 40, 346-358.

- N, Amsaveni & Harikrishnan. (2018). A scientometric analysis of environmental management research output during 1989 to 2014. *Library Philosophy and Practice (e-journal)*. 1846. <https://digitalcommons.unl.edu/libphilprac/1846>
- Senthilkumar, R., & Muthukrishnan, M. (2017). Scientometric mapping of publications productivity on British journal of cancer during 2005-2015. *Journal of Advanced Research of Library and Information Science*, 4(1-2), 17-22.
- Shukla, R. (2019). Indian research output on genetic disorder publication using the Scopus database: A scientometric study. *Collnet Journal of Scientometrics and Information Management*, 13(1), 1-12. DOI: 10.1080/09737766.2018.1550044
- Shukla, R., & Gupta, D. (2015). Global trend in web mining research publications during 2009-2018 using Scopus database: A scientometric analysis. In proceedings of *International Conference on "Digital Age Strategies in Information Management for Sustainable Librarianship"* organized by Department of Library and Information Science, University of Delhi, New Delhi to be held on 19<sup>th</sup> to 20<sup>th</sup> April 2019. 2019, (pp.420-427). Kumar, R.S. & Kaliyaperumal, K. A scientometric analysis of mobile technology publications. *Scientometrics*, 105, 921-939.
- Shukla, R., & Verma, M. K. (2019). Digital library research in India during 1989-2018: A scientometric analysis based on scopus database. *Journal of Information & Systems Management*, 9(2), 62-73. DOI: 10.6025/jism/2019/9/2/62-73
- Verma, M. K. & Shukla, R. (2019). Mapping the research trends on information literacy of selected countries during 2008-2017: A scientometric analysis. *DESIDOC journal of library & Information Technology*, 39(3), 125-130. DOI: 10.14429/djlit.39.3.14007
- Xiong, J. (2006). *Essential Bioinformatics*. The United States of America by Cambridge University, New York, (pp. 1-339).
- Yeshawant, V S., & Ravi, B. (2016). Scientometric dimensions of blood cancer research. *International Journal of Library and Information Studies*, 6(2), 83–89.