# A Scientometric Study on Bioinformatics during 2015 To 2019: Global Perspective

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#### Abstract

This paper investigates the Scientometric study on Bio Informatics during 2015 to 2019 using the Scopus Database during 2015 to 2019. The filtered the data of using the keywords Bioinformatics search. Totally 49830 documents were analyzed in the study. The growth of Bioinformatics research is highest number of publications is 15393 in 2019, an annual growth rate in 2019, 15393 (62.59%). Relative growth rate in year 2016 (0.67) increased and in 2018 is decrease level and exponential ratio and in arithmetic ratio in the explosion of the Bioinformatics research and doubling time increase in the time period in 2018 is 4.83. The author productivity among the five years period is 57272, in 2019, 15393 (26.88%), top ten cited documents during the five years is 22655 and in 2015, 11434 (50.47%) in the bioinformatics research.

**Keywords:** Bioinformatics, Scopus Database, Annual Growth Rate, Relative Growth Rate, Doubling Time and Degree of Collaboration

### **1. INTRODUCTION**

Bioinformatics is an interdisciplinary scientific field of life sciences. It is based on research and application include the analysis of molecular sequence and genomics data; genome annotation, molecular folding, modeling, and design; building biological networks; development of databases and data management systems and biomedical literature and text; and bioinformatics education and training.

### **1.1. SCIENTOMETRIC STUDY**

The word 'Scientometrics' originated from Russia, and perhaps Dobrov and Karennoi were the first to coin this term. They define it as "the measurement of information process". Scientometrics provides an understanding of the structure of scientific activity. The discipline being researched, the organizations involved the strength and deficiencies of the scientific groups, and their communication channels at different level of aggregation.

The origin of the term 'scientometrics' goes back to the year 1969, when two Russian scientists Nalimov and Mulechenko coined the Russian term 'naukometriya' the Russian equivalent of scientometrics (Nalimov and Mulechenko, 1969). However the advent of scientometrics as a discipline was in 1978, when the journal 'scientometrics' was founded by Tibor Braun In1978 scientometric defines its content as "scientometrics includes all quantitative aspects of the science of science, communication in science, and science policy." The focus of scientometrics is the measurement of science and is therefore concerned with the growth, structure, interrelationship and productivity of scientific disciplines.

# 2. REVIEW OF LITERATURE

**Rumeng (2020)** Mapping renewable energy subsidy policy research published from 1997 to 2018: A scientometric review."It is focused the key literature, historical research pathways, and research clusters and subsidy policies on the basis of three quantitative analysis methods including co-citation network analysis, historical path analysis, and bibliographic coupling analysis. It is based on a co-citation network analysis allowed the identification of influential studies used an energy subsidy policies. It analyzed in time range identifies "key nodes" (documentation), "historical pathways" (evolutionary history), and "intellectual clusters".

**Khalaj et al. (2020)** analyzed on "Green synthesis of nanomaterials - A scientometric assessment." The data were extracted from the Web of Science database during 1991 to 2019. It shows the result of out of 9 scientometric indicators are employed to interpret the results retrieved from the 8761 documents, 22, 400 Authors in 107 countries. In 2009, using the keyword" green synthesis and in 2010, "biosynthesis". The growth trend has green synthesis of nanomaterials displays up to now a sigmoid like growth pattern, which points actually to a decrease on new arrivals, thus suggesting a possible forthcoming decline in this field..

**Murugan (2019)** wrote an article "An 'Eye Disease' Research Output during 2009-2018: Scientometric Study." It is focused on recent years a using scientometric analysis for determining scientific trends in journal collaboration and growth. The present study e Keyword search an Eye disease from 2009 to 2018. It is found that the total numbers of 165,083.records are eye diseases during 2009 to 2018. The most of the accurate records is found in 2015, 19264 (11.66%), the Female, 42466 (61.23%) is more, an article types publication of rare eye diseases are naturally majority of the case reports and Classical Articles are same category (49.27%), totally 9,717 documents are exposed in the journal category,

In 2014, 5350 (12.04%) are top most level of Species - Human and majority of the records are scientifically derived from an AIDS28469 (97.38%).

### 3. Methodology

These data collected from the Scopus database for the period 2015 - 2019, nearly **49830** bibliographic records of contribution in the field of Research in Bioinformatics output over the period of 5 years.

The researcher applied the search string "Bioinformatics" that has used for the data extraction and analyzed by using MS Excel software applications as per the objectives of the study.

# 4. DATA ANALYSIS AND INTERPRETATION

### 4.1. GROWTH OF PUBLICATIONS

In table 1 and figure 1 explained the Growth of Publications in Bioinformatics Research. Totally 49830 publications among the five year periods published. The highest number of publications is 15393 in 2019 and lowest number of publication is 4607 in 2018. The average number of publication is 3079. It is observed the table, there is increasing trend in growth of the study period.

| Year  | Number of publications | Percentage | Cumulative | Cumulative Percentage |
|-------|------------------------|------------|------------|-----------------------|
| 2015  | 9467                   | 19.00      | 9467       | 19.00                 |
| 2016  | 9110                   | 18.28      | 18577      | 37.28                 |
| 2017  | 11253                  | 22.58      | 29830      | 59.86                 |
| 2018  | 4607                   | 9.25       | 34437      | 69.11                 |
| 2019  | 15393                  | 30.89      | 49830      | 100.00                |
| Total | 49830                  | 100.00     |            |                       |

### **Table .1 Growths of Publications**



Figure.1

### ANNUAL GROWTH RATE OF PUBLICATIONS

It is seen from the table.2. Annual Growth Rate of Publications during 2015 to 2019.

End Value - First Value

AGR = -----\*100

First Value

Table 2 and figure 2 reveals the annual growth rate of the Bioinformatics Research analyzed the year wise indicated. The values are increasing the year by year. In 2019 annual growth rate increasing from 62.59 and in 2018 value are 59.05. It is decreasing the year 2015 and increasing the year 2016 are 3.91 and figure 2 explained the linear fit Regression analyzed.

### **Table.2. Annual Growth Rate**

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| Year | Number of publications | Annual Growth Rate |
|------|------------------------|--------------------|
| 2015 | 9467                   | -                  |
| 2016 | 9110                   | 3.91               |
| 2017 | 11253                  | 19.04              |
| 2018 | 4607                   | 59.05              |
| 2019 | 15393                  | 62.59              |



Figure.2

Whereas,

Linear Fit: y=a+bx Standard Error: 4297.6177035 Correlation Coefficient: 0.2980180

The analyzed the annual growth rate of publications is value of linear regression in year 2015 decrease and year 2019 is increased the trend of the Regression weighted by  $x^2$ .

### **RELATIVE GROWTH RATE**

The Relative Growth Rate is the increase the growth in number of articles per unit in time. The Bioinformatics research trend analyzed the relative growth rate. The formula explained the table as below:

The relative growth rate is the increase in the number of publications/pages per unit of time. Here, one year is taken as the unit of time. The mean relative growth rate R (1-2) over a specified period of interval can be calculated from the following equation suggested by Mahapatra (1985).

$$W_2 - W_1$$
  
R (1-2) = ------  
T<sub>2</sub> - T<sub>1</sub>

Whereas,

| ,              |   |  |
|----------------|---|--|
| R              | = | Mean relative growth rate over the specific period of interval;            |
| $\mathbf{W}_1$ | = | log w <sub>1</sub> (Natural log of initial number of publications/ pages); |
| $\mathbf{W}_2$ | = | log w <sub>2</sub> (Natural log of initial number of publications/pages);  |
| $T_2-T_1$      | = | Unit difference between the initial time and final time.                   |
| Therefore,     |   |  |
| <b>R</b> (a)   | = | Relative growth rate per unit of publications per unit of time (year)      |
| R (p)          | = | Relative growth rate per unit of pages per unit of time (year)             |
|                |   |  |

It evident from the table explained the Relative growth rate in year 2016 (0.67) increased and in 2018 is decrease level. It is conclude the growth of Bioinformatics research not in exponential ratio and in arithmetic ratio in the explosion of the Bioinformatics not taken place of this study.

| Years | No. of<br>Publication | cumulative | w1    | w2    | R(a) | Mean(a)1-2 | Doubling<br>Time | Mean pt<br>(a)1-2 |
|-------|-----------------------|------------|-------|-------|------|------------|------------------|-------------------|
| 2015  | 9467                  | 9467       |       | 9.16  | -    |            |                  |                   |
| 2016  | 9110                  | 18577      | 9.16  | 9.83  | 0.67 |            | 1.03             |                   |
| 2017  | 11253                 | 29830      | 9.83  | 10.30 | 0.47 | 2.16       | 1.46             | 1.84              |
| 2018  | 4607                  | 34437      | 10.30 | 10.45 | 0.14 |            | 4.83             |                   |
| 2019  | 15393                 | 49830      | 10.45 | 10.82 | 0.37 |            | 1.88             |                   |

### Table.3.Relative Growth Rate and Doubling Time

### **DOUBLING TIME**

Therefore,

A direct equivalence exists between the relative growth rate and doubling time. If the number of publications/pages of a subject doubles during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. This difference has a value of 0.693. Thus, the corresponding doubling time for publication and pages can be calculated by the following formula:

$$\begin{array}{rcl} 0.693\\ \text{Doubling time (Dt)} &=& & & \\ & & & \\ & & & \\ \text{Doubling time for publications Dt (a)} &=& & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\$$

The doubling time increase in the time period in 2018 is 4.83 and 2017 is 1.46. The decreasing the doubling time in 2015 is 1.03. It is explained the increasing the trend and after decreasing and but it is not showing the exponential growth rate.

# **AUTHORS PRODUCTIVITY**

| Year  | Total Authors | Percentage | Cumulative | Cumulative Percentage |
|-------|---------------|------------|------------|-----------------------|
| 2015  | 9467          | 16.53      | 9467       | 16.53                 |
| 2016  | 9110          | 15.91      | 18577      | 32.44                 |
| 2017  | 11253         | 19.65      | 29830      | 52.08                 |
| 2018  | 12049         | 21.04      | 41879      | 73.12                 |
| 2019  | 15393         | 26.88      | 57272      | 100.00                |
| Total | 57272         | 100.00     |            |                       |

### Table .4 .Year wise Authors Productivity



#### Figure.3

In table 4 and figure.3 shows the year wise author productivity during 2015 to 2019. Out of 57272 total authors, in 2015, 9467 (16.53%) followed by 2016, 9110 (15.91%), 2017, 11253 (19.65%), 2018, 12049 (21.04%) and 2019, 15393 (26.88%). It is observed the data number of author productivity in 2019 (26.88%) and less number of authors in 2016 (15.91%).

### **TOP TEN CITED DOCUMENTS**

In table 5 reveals the year wise top ten Cited Documents during 2015 to 2019. Totally 22655 cited documents in year 2015, 11434 (50.47%) followed by 2016, 6787 (29.96%), 2017, 2508 (11.07%), 2018,

978 (4.32%) and in 2019, 948 (4.18%). It is seen from the table majority of the top ten cited documents in 2015 (50.47%) and in 2019, (4.18%) are very less.

| Year  | Top 10 Cited | Percentage | Cumulative | Cumulative Percentage |
|-------|--------------|------------|------------|-----------------------|
| 2015  | 11434        | 50.47      | 11434      | 50.47                 |
| 2016  | 6787         | 29.96      | 18221      | 80.43                 |
| 2017  | 2508         | 11.07      | 20729      | 91.50                 |
| 2018  | 978          | 4.32       | 21707      | 95.82                 |
| 2019  | 948          | 4.18       | 22655      | 100.00                |
| Total | 22655        | 100.00     |            |                       |

### Table.5. Year wise top ten Cited Documents





### **AUTHORSHIP PATTERN OF PUBLICATIONS**

### Year wise Authorship Pattern

The authorship Pattern of publications explained the table 5 and figure.5. It is indicated the single author Two authors and Multiple authors. In 2015, single author (4.98%) followed by two authors (12.61%) and multiple authors (82.41%). In 2016, single author (5.41%) followed by two authors (10.60%) and multiple authors (83.98%).In 2017,

Single author (8.68%) followed by two authors (19.11%) and multiple authors (72.20%). In 2018, single author (3.92%) followed by two authors (10.25%) and multiple authors (85.83%) and In 2019, single author (2.71%) followed by two authors (3.28%) and multiple authors (94.01%). It is observed the table majority of the multiple authors and in year 2019 authorship pattern (26.88%) and in 2016 (15.91%) are very less.

### Table.6.Year wise Authorship Pattern

| S.No | Years | Authorship Patter | 'n          |                  | Total |
|------|-------|-------------------|-------------|------------------|-------|
|      |       | Single Author     | Two Authors | Multiple authors |       |

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| 1     | 2015 | 471  | 1194  | 7802  | 9467   |
|-------|------|------|-------|-------|--------|
|       |      | 4.98 | 12.61 | 82.41 | 16.53  |
| 2     | 2016 | 493  | 966   | 7651  | 9110   |
|       |      | 5.41 | 10.60 | 83.98 | 15.91  |
| 3     | 2017 | 977  | 2151  | 8125  | 11253  |
|       |      | 8.68 | 19.11 | 72.20 | 19.65  |
| 4     | 2018 | 472  | 1235  | 10342 | 12049  |
|       |      | 3.92 | 10.25 | 85.83 | 21.04  |
| 5     | 2019 | 417  | 505   | 14471 | 15393  |
|       |      | 2.71 | 3.28  | 94.01 | 26.88  |
| Total |      | 2830 | 6051  | 48391 | 57272  |
|       |      | 4.94 | 10.57 | 84.49 | 100.00 |



Figure.5

# DEGREE OF COLLABORATION

The collaboration means two or more authors contributed work related any project or particular field. It is analyzed the degree of collaboration are multiple authors contributed to any publications.

Table.6.Authorship Pattern and Collaborative Trend in 2015-2019

| Years | Single | Two     | Multi   | Total | Degree of      | Mean in Degree |
|-------|--------|---------|---------|-------|----------------|----------------|
|       | Author | Authors | authors |       | Collaborations | of             |
|       |        |         |         |       |                | Collaborations |

| 2015  | 471  | 1194 | 7802  | 9467  | 0.95 |       |
|-------|------|------|-------|-------|------|-------|
| 2016  | 493  | 966  | 7651  | 9110  | 0.94 |       |
| 2017  | 977  | 2151 | 8125  | 11253 | 0.91 | 0.946 |
| 2018  | 472  | 1235 | 10342 | 12049 | 0.96 |       |
| 2019  | 417  | 505  | 14471 | 15393 | 0.97 |       |
| Total | 2830 | 6051 | 48391 | 57272 | 4.73 |       |

The explained the formula Subramaniyam (1983) as follows:

NM

The author Subramaniyam stated the formula C = ------

NM+NS

Whereas,

NM = Number of Multiauthors Papers

NS = Number of Single author Papers

C = Degree of Collaborations

It is evident from the table Collaboration with the Bioinformatics Research Publication Productivity analyzed the study period during 2015 to 2019 (0.946) reveals the multi author papers. Year wise analyzed the study reveals the degree of collaboration is (0.97) in 2017 and (0.96) in 2018. The measure trend extended mean in degree of collaborative coefficient with multiauthors papers. The majority of the papers are Multiauthors are maximum and single author papers are very less.

### COLLABORATION INDEX

The collaborative Index means number of authors published as joint papers. This type analyzed main number of authors per joint authored papers as used the formula:

**Total Authors** 

Collaboration Index = -----

Total Joint Authors

The above table shows the collaboration Index ranges in year 2015 (6.53) and year 2019 (28.66) and average of 8 per joint authored papers applied the researchers falls between multiauthored papers in the research in Bioinformatics.

### Table.7. Collaborative Index in 2015-2019

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| Years | Multi Authors Publications | <b>Total Authors of Multiauthors</b> | Collaboration Index |
|-------|----------------------------|--------------------------------------|---------------------|
| 2015  | 1194                       | 7802                                 | 6.53                |
| 2016  | 966                        | 7651                                 | 7.92                |
| 2017  | 2151                       | 8125                                 | 3.78                |
| 2018  | 1235                       | 10342                                | 8.37                |
| 2019  | 505                        | 14471                                | 28.66               |
| Total | 6051                       | 48391                                | 8.00                |

### **5. CONCLUSION**

From the analysis of this study conclude an examined the Scientometric study on Bio Informatics research during 2015 to 2019 using the Scopus database. It is found the 49830 publications were published in Mapping of scholarly communication through the field of Bioinformatics. The total publications highest of the year in 2019 is 15393 and the level of gradually decrease and increase. The annual growth rate increasing in 2019 (62.59) and 2016 (3.91) are indicated in the trend. The Relative growth rate in year 2016 (0.67) increased and in 2018 is decrease level. It is indicated the doubling time increase in the time period in 2018 is 4.83, 2017 is 1.46 and decreasing the doubling time in 2015 is 1.03. The majority of an author productivity in 2019 (26.88%) Top cited papers in 2016, 6787 (29.96%), Authorship pattern of Multiple authors in 2016 (84.49%) and year 2019 (26.88%). The degree of Collaboration is (0.97) in 2017 and Collaborative Index in 2019 (28.66%). The study reveals a large number of researches in bioinformatics in future hope that the published papers in coming years.

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