



## Scintometric Analysis of Biotechnology Research Output in India Reflected in Web of Science: A Study

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### ABSTRACT

*Biotechnology is the offshoot of science with its revolutionary contribution Biotechnology considered as the third wave in biological science. With its increasing importance of biotechnology in this ever growing world most of the nations involved in research and development in this area for further improving the application and utility of this revolutionary technology. Realizing the role of this technology India also actively involved in the research of biotechnology are and government of India established a separate department in the year 1986 to boost the research and development activities in the areas of biotechnology. In this paper we have made an attempt to analyze the biotechnology research trends in India in terms of yearly research output, Exponential Growth Rate, top productivity of authors, contribution of various research institutions and pattern of collaboration among the researchers.*

**Keywords :** Biotechnology, biological science, Scientometrics, Citation Analysis

### Introduction

Biotechnology is a major research area for every nation today because biotechnology is going to address many problems faced due to rapid growth of population and scarcity of the resources. Realizing the potency of this technology most of the developed and developing nations promoting the research in this area to get maximum benefit through innovative and economic biotechnology products. India being the champion of IT revolution tried to compete with developed countries even in the area of biotechnology and proved its potency in biotechnology which can be understood by the trends analyzed through scintometric. Scintometric study is research technique to measure the quantitative as well as qualitative research output in a field study in this paper we use this technique to measure the research output of India in the field of Biotechnology.

### Objective

This study to analyze the Indian research output in the field of Biotechnology during the period 1999-2012 and the analyses included year wise growth, Exponential growth rate, author wise contribution, share of top scholarly journals, share of international collaborative papers, patterns of research communication in most productive journals and pattern of collaboration among authors. It also analyses the characteristics of most productive institutions, authors and high-cited papers.

### Methodology

Data was collected from the Web of Science (WoS). The WoS is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). SCI database is one of the very comprehensive databases covering all aspects of science. The study period (1999-2012) is selected as the database is available in machine from since 1982. The search string "Biotechnology" in the "Basic search" field of for the years 2000-2011 to download the records on the subjects 'Biotechnology' restricted to India. A total of 756 records were downloaded and analyzed by using the web of science web-

site application as per the objectives of the study.

### Analysis and Discussion

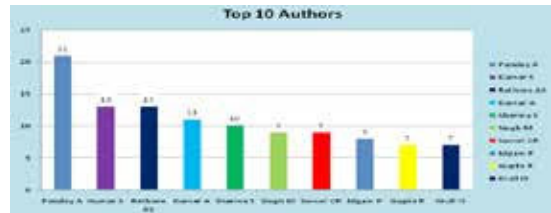
**Table: 1 Exponential Growth Rate of the Biotechnology Research Output in India**

| S.No | Year  | No of Records | Exponential Growth Rate |
|------|-------|---------------|-------------------------|
| 1    | 1999  | 21            | -                       |
| 2    | 2000  | 31            | 1.48                    |
| 3    | 2001  | 32            | 1.03                    |
| 4    | 2002  | 26            | 0.81                    |
| 5    | 2003  | 32            | 1.23                    |
| 6    | 2004  | 37            | 1.16                    |
| 7    | 2005  | 42            | 1.14                    |
| 8    | 2006  | 50            | 1.19                    |
| 9    | 2007  | 49            | 0.98                    |
| 10   | 2008  | 81            | 1.65                    |
| 11   | 2009  | 66            | 0.81                    |
| 12   | 2010  | 85            | 1.29                    |
| 13   | 2011  | 113           | 1.33                    |
| 14   | 2012  | 91            | 0.81                    |
|      | Total |               | 14.91(1.07)             |

The Table 2 reveals that the Exponential growth rate of publications in Biotechnology research output in India. An exponential growth in number of publication was observed during 1999 to 2012, the study shows that there is a uniform growth in output as there is no significant variation. The average growth rate from 1999 to 2012 is 1.07 and the year 2008 recorded highest growth rate with 1.65.

**Table: 2 Top ten Most Productive Authors in Biotechnology research**

| S.No | Author     | Records | TLCS | TGCS | h-Index |
|------|------------|---------|------|------|---------|
| 1    | Pandey A   | 21      | 45   | 1463 | 10      |
| 2    | Kumar S    | 13      | 4    | 113  | 4       |
| 3    | Rathore AS | 13      | 14   | 85   | 3       |
| 4    | Kumar A    | 11      | 4    | 297  | 3       |
| 5    | Sharma S   | 10      | 3    | 173  | 7       |
| 6    | Singh M    | 9       | 3    | 225  | 5       |
| 7    | Soccol CR  | 9       | 42   | 1351 | 7       |
| 8    | Nigam P    | 8       | 42   | 1411 | 7       |
| 9    | Gupta R    | 7       | 6    | 360  | 6       |
| 10   | Krull IS   | 7       | 5    | 9    | 2       |



**Figure: 1 Top 10 Authors**

Table: 2 and Figure: 1 reflect the contribution of top 10 most productive authors in Biotechnology research in India. There are totally 2112 authors involved in producing total 756 records and above table shows top ten authors among them. Pandey A tops the list with the contribution of 21 records; he also tops the list in terms of quality analysis as he is top in TLCS (45), TGCS (1463) and H-Index (10). Kumar S and Rathore A S stands second and third respectively in the list but their H-index is not satisfactory with total number of records because Soccol C R, Nigam P and Sharma S having H-Index 7 though their total records are lesser than second, third and fourth authors in the list.

**Table: 3 Collaboration Pattern of Authorship in Biotechnology research in India**

|                       | 1999 | 2000 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11  | 12 | Total | Percentage |
|-----------------------|------|------|----|----|----|----|----|----|----|----|----|----|-----|----|-------|------------|
| Single authors        | 6    | 5    | 16 | 7  | 10 | 11 | 5  | 3  | 7  | 18 | 9  | 17 | 13  | 1  | 128   | 16.93      |
| Double authors        | 6    | 10   | 7  | 6  | 6  | 8  | 11 | 8  | 12 | 13 | 13 | 23 | 19  | 25 | 167   | 22.09      |
| Triple authors        | 4    | 8    | 4  | 3  | 7  | 8  | 9  | 16 | 12 | 14 | 12 | 16 | 32  | 21 | 166   | 21.96      |
| Four authors          | 3    | 2    | 4  | 6  | 3  | 3  | 9  | 9  | 7  | 14 | 14 | 13 | 19  | 20 | 126   | 16.67      |
| Five authors          | -    | 2    | -  | 3  | 2  | 2  | 4  | 6  | 4  | 13 | 8  | 6  | 10  | 9  | 69    | 9.12       |
| Six authors           | 1    | 3    | -  | -  | 1  | 3  | 1  | 3  | 5  | 4  | 5  | 6  | 10  | 6  | 48    | 6.35       |
| Seven authors         | -    | -    | -  | 1  | 1  | 2  | 1  | 3  | -  | 1  | -  | 1  | 6   | 3  | 19    | 2.51       |
| Eight authors         | 1    | -    | -  | -  | 2  | -  | -  | -  | 1  | 1  | 2  | 1  | 1   | 2  | 11    | 1.46       |
| Nine authors          | -    | -    | -  | -  | -  | -  | -  | 1  | -  | 3  | 1  | -  | 2   | 1  | 8     | 1.06       |
| Ten authors and above | -    | 1    | 1  | -  | -  | -  | 2  | 1  | 1  | -  | 2  | 2  | 1   | 3  | 14    | 1.85       |
| Total                 | 21   | 31   | 32 | 26 | 32 | 37 | 42 | 50 | 49 | 81 | 66 | 85 | 113 | 91 | 756   | 100        |

Table 3 and graph reflects the collaboration pattern of authorship. Out of 756 records 128 are contributed by single authors which are 16.93 percent of total output. 167 records are contributed by double authors which are 22.09 percent of total output and which tops percentage wise contribution and contribution by three authors stands second with 166 records followed by single authors in the rank. Contribution by single author, double authors and three authors together stands more than 60 percent and remaining 40 percent contribution came from four and more than three authors with the major contribution of four authors. Analysis of this collaborative pattern in though quite good in collaboration but as compare to other areas of research it demands still more collaboration because majority of the papers came from single and double authors.

**Table: 4 Top 10 Most Productive Institutions of Biotechnology Research Output in India**

| S. No | Institution   | Records | TLCS | TGCS |
|-------|---|---------|------|------|
| 1     | Indian Institute of Technology                        | 56      | 20   | 907  |
| 2     | University of Delhi                                   | 34      | 14   | 704  |
| 3     | Council of Scientific and Industrial Research         | 28      | 34   | 760  |
| 4     | Indian Agricultural Research Institute                | 19      | 3    | 84   |
| 5     | Indian Institute of Science                           | 14      | 4    | 85   |
| 6     | National Chemical Laboratory                          | 14      | 3    | 236  |
| 7     | Annamalai University                                  | 13      | 0    | 85   |
| 8     | Central Food Technological Research Institute (CFTRI) | 12      | 1    | 357  |
| 9     | Banaras Hindu University                              | 10      | 3    | 116  |
| 10    | Bharathidasan University                              | 10      | 11   | 100  |

Table: 4 reflects the research profile of the most productive institutions in Biotechnology research in India. The top 10 most productive institutions involved in research in Biotechnology are identified out of these Indian Institutes of Technology stands top followed by university of Delhi and Council of Scientific and Industrial Research with 56, 34 and 28 records respectively. It is interesting to note among these top ten institutes three state and one central university namely Delhi University, Annamalai University, Bharathidasan University and Banaras Hindu University and two state universities are from Tamil Nadu state.

**Table: 5 Top 10 Collaborative Country of Biotechnology Research Output in India**

| S.No | Country         | Records | TLCS | TGCS |
|------|-----------------|---------|------|------|
| 1    | India           | 722     | 184  | 9619 |
| 2    | USA             | 44      | 13   | 326  |
| 3    | Unknown         | 26      | 6    | 96   |
| 4    | UK              | 17      | 45   | 1552 |
| 5    | Brazil          | 11      | 42   | 1352 |
| 6    | Canada          | 10      | 6    | 252  |
| 7    | Germany         | 9       | 0    | 45   |
| 8    | France          | 8       | 3    | 191  |
| 9    | South Korea     | 8       | 0    | 47   |
| 10   | Peoples R China | 7       | 1    | 100  |

Table 5 explains the involvement various countries in the biotechnology research output came from India. Naturally India stands top with 722 papers out of 756 papers followed by USA, UK, Brazil, Canada, Germany and France. Here an in-

interesting fact is that though UK and Brazil having less number of papers but their global and local citations are very high which reflect the quality of their work in the field of biotechnology.

#### Findings and Suggestions

- There is no much variation in the early output up to 2005 but from 2005 onwards there is significant development in the research output of biotechnology.
- In terms of exponential growth there is linear growth during the period take for the study.
- Contribution of single and double authors is dominating; there is a need of promoting further collaboration in the field of biotechnology research in India.
- The journal Current Science dominates the top journal list with highest publications, but in case of citations Bioresource Technology, Biotechnology Advances, Critical Reviews In Biotechnology And Applied Microbiology And Biotechnology stands ahead of all other journals though with less number of papers which is an indication of their quality.

- As against common phenomena contribution of universities is better than other research institute in the field of biotechnology research in India.
- In case of collaboration India collaborated with most of the developed nations but there is a need to have collaboration with the developing nations in the field of Biotechnology research.

#### Conclusion

Biotechnology has shown another industrial revolution with its novel applications. Most of the nations are very enthusiastic to grow with biotechnology and India is not exception for it in fact it is doing better than others with the assistance of its IT applications in Biotechnology which can be realized from this study. Though India is performing well in the field of biotechnology research it is not satisfactory when we compare with our human resource so there is a need of furthering the research to provide more employment and income to the nation with huge demographic dividend.

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