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Trends in Research on Gene Cloning during 2001-15 : A Scientometric Study

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Abstract

Scientometric studies are used to identify the trends in the pattern of publication, authorship, collaboration in research, author productivity, the scattering of literature and core journals over a period of time and there by offering insight into the dynamics of the area under study. The main objective of the growth of literature on Gene Cloning is to examine the pattern of publication output in Gene Cloning literature during the study period, to identify and analyze the production of Gene Cloning literature output and to assess the extent of research carried out in India on Gene Cloning Research. This study is confined to the literature covered in the MEDLINE bibliographic database covering the period from 2001-2015. There is a gradual decreasing trend of literature in the subject of study on a year wise basis. The Gene Cloning literature output has been grouped in 23 major sub-fields based on the selected database. There is a decreasing trend in the year wise RGR in the field of Gene Cloning research output. The Relative Growth rate (RGR) in the year 2001 is 0.66 which has been gradually decreased to 0.05 in 2015. However the Doubling time (Dt) has shown an increasing trend. 96.58% represent two and more authors, which implies that collaborative research is evident in the Gene cloning research and it is the same in most of the scientific fields.

keywords : Scientometrics, Gene Cloning, MEDLINE, Bibliographic Database, Relative Growth rate, Doubling time, Collaborative research

1. Introduction

Gene cloning is a population of genetically identical cells or organisms being derived from the same cell or from the same individual. The genetic endowment is possible only if

the cells or organisms are derived from the single parent by nonsexual methods. The word clone is derived from Greek word meaning “twig”, because cloning is traditionally favourite amongst horticulturists, who produce an entire tree or shrub by just planting a twig from the parent plant.

Scientometric analysis is a extensive applications in the field of Library and Information Science and information centres to identify the research trends in a particular discipline or particular field of knowledge. MEDLINE is the world popular abstract and bibliographic database of peer-reviewed literature. This database covers more than 5000 titles of biomedical and related journals published in USA and seventeen other foreign countries. MEDLINE database covers the following medicine and other related fields, namely medicine, dentistry, nursing, the health care system, veterinary medicine, and the preclinical sciences and also covers a lot of literature in biology, biochemistry and molecular evolution. In year 2001, National Library of Medicine(NLM) reconfigured MEDLINE to contain only citations to journal articles. NLM provides free access to MEDLINE data through PubMed. In addition to providing the PubMed search interface, the NLM is also given licenses the content of MEDLINE to commercial database vendors. For a fee, these vendors will provide the content of the database through an interface with different search features and capabilities than PubMed .

2. Review of Literature

Abramo, D Angelo and Di Costa (2014) have applied a bibliometric approach based on the scientific production of the entire public research system in the hard sciences sphere at Italy, for the period of five 5 years from 2006–2010. They identified the territorial scientific specializations present in Italy, at the levels of regions and provinces (NUTS2 and NUTS3).

Hebentonl and Jou (2013) conducted a study to identifies tropes and trends in purpose, method, theory, and collaborative networks of criminological research on Taiwan, which is published in English-language literature of criminological research in Taiwan – for the period between 2000 and 2010 which sets the findings against other Asian comparators. The findings reveal that, a mirror up to the criminological communities in both Taiwan and other parts of the English-speaking world.

Cantos Mateos, et al (2012) highlighted a dual analysis of Spain's scientific research productivity during the period from 1997 to 2007. They employed various

bibliometric tools of a basic nature as well as techniques for the visualization and analysis of networks of scientific information based on a study of KeyWords Plus. It is found that the output is mainly concentrated in Cataluna and Madrid, and hospitals are the most productive centres, where the main authors are affiliated. Main categories are haematology, oncology and biophysics.

Rana (2011) identified the trends and patterns in PhD research at Department of Library and Information Science, Punjab University, Chandigarh for period from 1957 to 2009 by PhD students. The last two decades increasing slowly until around 1980, when it increased by more than 5 times during the 1980s. In the 1990s, the number of PhD theses are found doubled. The growth has been slowed down during the next decade, during which 266 theses were completed. The 1990s recorded a rapid growth in both the number of doctoral degrees awarded and the geographic spread of universities/institutes offering doctoral degree programmes in the country.

3. Objectives of the study

The study has been designed with the following objectives;

- To examine the growth of literature on Gene Cloning literature published during 2001-2015.
- To examine the pattern of publication output in Gene Cloning literature during the study period.
- To assess the extent of research carried out on Gene Cloning research.
- To apply the certain Bibliometric indicators to determine the extent, nature and the size of co-authorship research Degree of Collaboration (DC) in Gene Cloning literature.
- To apply the Bradford Law of Scattering in Gene Cloning research.

4. Methodology

Extraction of Data on Gene Cloning research for the purpose of study MEDLINE bibliographic database has been used and searched using the word “Gene Cloning” research for the period between 2001 and 2015 and extracted 66,790 records with full bibliographical details such as Title, Authors, Source, Year, Volume, Abstract, Country and so on. Information collected through survey was analyzed by using different conventional statistical tools like tables, percentages, mean, Cumulative percentage. After the collection of primary

data, they are analyzed by using the tool of SPSS (Statistical Packages for Social Sciences). Necessary tables are generated using the package and analyzed to bring out interpretation.

5. Analysis and Interpretation

In this study, the following bibliometric / scientometric techniques were employed while analysing the data on Gene Cloning research output collected from the MEDLINE data which are covered in the Pubmed (www.pubmed.com).

- Relative Growth Rate (RGR)
- Doubling Time (Dt)
- Degree of Collaboration (DC)
- Collaborative Coefficient (CC)
- Bradford Law of Scattering

5.1 Quantum of literature published in gene cloning from 2001 to 2015

The research productivity on ‘Gene Cloning’ covered in the database is shown in Table 1. It is observed that 66790 records on ‘Gene Cloning’ are covered in the total output of MEDLINE database in the study period. The literature has been classified according to year of publication. It is found that there is a gradual decreasing trend of literature in the subject of study year wise. The year 2001 has marked a maximum of 8.61% out of total productivity in the study period.

Table 1 - Quantum of Literature published year wise

Sl. No.	Year	Frequency	Percentage	Cumulative %
1	2001	5749	8.61	8.61
2	2002	5357	8.02	16.63
3	2003	5155	7.72	24.35
4	2004	5082	7.61	31.96
5	2005	4651	6.96	38.92
6	2006	4432	6.64	45.56

7	2007	4424	6.62	52.18
8	2008	4288	6.42	58.6
9	2009	4311	6.45	65.05
10	2010	4082	6.11	71.16
11	2011	3996	5.98	77.14
12	2012	4397	6.58	83.72
13	2013	3956	5.92	89.64
14	2014	3478	5.21	94.85
15	2015	3432	5.15	100.00
Total		66790	100.00	

5.2 Quantum of gene cloning research output according to sub-fields

It has been found that the Gene Cloning literature output has been grouped in 23 major sub-fields based on database covered. Therefore the literature has been grouped in those major sub-fields and the data is presented. It is observed that majority of the literatures are covered on “Biochemistry” followed by “Veterinary Science” and “Genetics”.

Table 2 - Research output based on sub-fields

Sl. No.	Sub-field	No. of Contribution	Percentage	Cumulative Total	Cumulative %
1	Biochemistry	20536	30.75	20536	30.75
2	Veterinary Science	12066	18.07	32602	48.81
3	Genetics	10401	15.57	43003	64.39
4	Molecular Biology	6672	9.99	49675	74.37

5	Gastroenterology	2657	3.98	52332	78.35
6	Amino Acids	1851	2.77	54183	81.12
7	Enzymology	1686	2.52	55869	83.65
8	Pharmacology	1636	2.45	57505	86.10
9	Cell culture	1248	1.87	58753	87.97
10	Physiology	1062	1.59	59815	89.56
11	Adult	1021	1.53	60836	91.09
12	Biotechnology	655	0.98	61491	92.07
13	Immunology	591	0.88	62082	92.95
14	Geriatrics	474	0.71	62556	93.66
15	Agriculture	422	0.63	62978	94.29
16	Oncology	264	0.40	63242	94.69
17	Microbiology	230	0.34	63472	95.03
18	Ascomycota	218	0.33	63690	95.36
19	Pathology	207	0.31	63897	95.67
20	Virology	207	0.31	64104	95.98
21	Biodegradation	172	0.26	64276	96.24
22	Algorithms	170	0.25	64446	96.49
23	Obstetrics and Gynaecology	79	0.12	64525	96.61
	Others	2265	3.39	66790	100.00
	Total	66790	100.00		

5.3 RGR and Dt for Gene Cloning Research Output by year wise

It is noticed that there is a decreasing trend in the year wise RGR in the field of Gene Cloning research output. The RGR in the year 2001 is 0.66 which has been gradually decreased to 0.05 in 2015.

Similarly the Dt has shown an increasing trend. The Dt for the year 2001 was 1.06 and enhanced gradually to 14.05 in 2015.

Table 3 - Trend of RGR and Dt shown

Year	Quantum of Output	Cumulative Total of Output	W ₁	W ₂	$1 - 2^{\overline{R}(aa^{-1} year^{-1})}$ RGR	Dt(a)
2001	5749			8.66		
2002	5357	11106	8.66	9.32	0.66	1.06
2003	5155	16261	9.32	9.70	0.38	1.84
2004	5082	21343	9.7	9.97	0.27	2.58
2005	4651	25994	9.97	10.17	0.20	3.54
2006	4432	30426	10.17	10.32	0.15	4.53
2007	4424	34850	10.32	10.46	0.14	4.99
2008	4288	39138	10.46	10.57	0.11	6.03
2009	4311	43449	10.57	10.68	0.11	6.34
2010	4082	47531	10.68	10.77	0.09	7.77
2011	3996	51527	10.77	10.85	0.08	8.68
2012	4397	55924	10.85	10.93	0.08	8.48
2013	3956	59880	10.93	11.00	0.07	9.89

2014	3478	63358	11	11.06	0.06	12.25
2015	3432	66790	11.06	11.11	0.05	14.05

5.4 Authorship Pattern in Gene Cloning

The year wise distribution of contributions according to number of authors is shown in Table 4. It is evident that more than one-third (43.68%) of the contributions were by more than five authors. 96.58% represent two and more authors, which means collaborative research is evident in the Gene cloning research and it is same in most of the scientific fields.

Table 4 - Authorship pattern in Gene Cloning

Author (s)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	No. of records	%
Single Author	202	171	521	147	116	111	89	67	92	60	60	246	78	38	36	2034	3.05
Two Authors	651	572	708	516	422	389	424	371	372	286	273	414	262	200	196	6056	9.07
Three Authors	907	777	835	725	620	617	582	530	555	494	440	582	396	346	278	8684	13.00
Four Authors	985	923	857	827	758	733	655	670	652	592	555	671	593	472	460	10403	15.58
Five Authors	900	804	667	764	746	725	709	680	646	664	606	643	616	524	495	10189	15.26
More than Five Authors	2104	2110	1383	2100	1989	1857	1965	1970	1994	1986	2061	1787	2006	1897	1967	29176	43.68
Anonymous	0	0	184	3	0	0	0	0	0	0	1	54	5	1	0	248	0.37
Total	5749	5357	5155	5082	4651	4432	4424	4288	4311	4082	3996	4397	3956	3478	3432	66790	100.00

5.5 Distribution of Journals in Gene Cloning based on Bradford Law of Scattering

Accordingly the journals are grouped in to three zones producing a similar number of articles. The distribution of journal is shown zone wise in Table 5. It is seen that 32 core journals in zone-1 published 21591 articles. Similarly the second zone comprises of 138 journals and 2255 journals grouped in third zone.

Table 5 - Distribution by Zone of cited journals and references in Gene Cloning

Zone	No. of Journals		No. of Papers	
	No.	(%)	No.	(%)
Zone 1	32	1.32	21591	33.55
Zone 2	138	5.69	21450	33.33
Zone 3	2255	92.99	21309	33.11
Total	2425	100.00	64350	100.00

Conclusion :

A total of 66790 contributions were covered in MEDLINE database for the period between 2001 and 2015. A total of 64525 contributions cover 23 major sub-fields of Gene Cloning research productivity during the study period from 2001 to 2015 (except others). Out of 23 sub-fields the maximum numbers of contributions are covered on Biochemistry” followed by “Veterinary Science” and “Genetics”. There exists decreasing in Relative Growth Rate and increasing in Doubling Time for research productivity on Gene Cloning throughout the study period. More than one-third (43.68%) of the contributions were by more than five authors. 96.58% represents two and more authors, which means collaborative research is evident in the Gene cloning research. The research productivity of Gene Cloning confirms the implications of Bradford’s Law of Scattering.

Scope for further research

The present study of research productivity on Gene Cloning avenues for further research on the following areas;

- The extent and pattern of collaboration research in the sub-fields of Gene Cloning.
- The citation pattern in the Gene Cloning research contributions.
- The nature and patterns of research collaboration in Gene Cloning with a view to ascertain the impact of factors such as country-wise, their affiliation, specializations, experience, etc.
- Mapping the literature in Gene Cloning publications.

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