Scientometric Analysis of Literature on Cloning, 1999-2010

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Abstract

The present study identifies and explores the characteristics of cloning literature from 1999 to 2010 based on the Web of Science database. The final data considered 20,124 records. Specific areas addressed were: year-wise growth of publications, Relative Growth Rate (RGR) and Doubling Time (Dt), subject dispersion, document type, productive authors, journals, institution productivity. The results of this study reveal that a declining trend in the number of publications in cloning literature was observed from 1999 to 2010. Among the top producing authors, Zhang, Y. from People's Republic of China with 109 papers published ranks first. The Journal of Biological Chemistry is the largest contributor (639) to the journal literature on cloning literature.

Keywords

Applied Genetics, Cloning, Gene Cloning, Genetics and Scientometrics

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INTRODUCTION

The science of genetics is essentially a product of the period since the 1880s, but the rate of scientific advance in applied genetics during the last decade of the twentieth century has been truly remarkable (Sunil Kumar, 2006). Emmanuel, et al. (2006) opine that genetics is the science of heredity that involves the structure and function of genes and the way genes are passed from one generation to the next. Applied genetics refers to the structure and function of genes and their involvement in various practical fields, and reflects the dynamic nature of the field of genetics.

Gregor Johann Mendel, the Austrian monk is considered the father of Genetics for his original contributions related to the theory of inheritance and the theory of transmissible factors in 1866 (Brown, 2009 and Orel, 1995). He formulated a set of rules to explain the inheritance of biological characteristics. The basic assumption of these rules is that each heritable property of an organism is controlled by a factor, called a *gene*, normal is a physical particle present somewhere in the cell. The discovery of Mendel's laws in 1900 marks the birth of *genetics*, the science aimed at understanding what these genes are and exactly how they work. From 1900 onwards many discoveries were made to identify the transmissible factors, such as that of chromosome, nucleic acid, DNA, etc. Watson and Crick (1953) described the structure of DNA in 1953 and from then onwards genetics has become one of the most exciting and ground-breaking sciences.

Applied genetics has revolutionized the world today through the development of *gene cloning* in the 1970s, *PCR (Polymerase Chain Reaction)* in the 1980s, *Sequencing of Genomes* in the 1990s and *Stem Cell Research* in the 2000. Cloning can provide a pure sample of an individual gene, separated from all the other genes with which it normally shares the cell. Before cloning techniques were developed it was impossible to obtain purified samples of individual genes. This meant that work on gene structure and expression had to deal with genes in general terms, rather than concentrating on the particular features of a single specified gene. Brown (2004) explains that there was no way of building on the information provided by Mendelian analysis and progress in many areas of genetics became blocked. Cloning provided the spur that enabled genetic research to get back in gear.
Dolly, the Sheep, was the first successfully cloned mammal (lamb). Wilmut (1997) and others at Roslin

Institute UK are the pioneers. Gradual improvements and developments in cloning technology have enabled scientists to generate mouse, cattle, goat, dear etc. Are the humans next? Questions began to arise within the scientific community, governments and organizations. It would be advantageous to science and medicine to clone tissues and organs rather than human beings.

Related Studies

Gupta et al. (1998) in their paper use a comprehensive bibliography, 'Bibliography of Theoretical Population Genetics' as the source data. The bibliography covers literature on population genetics from 1870 to 1980. Based on an analysis of the bibliography the authors identified eleven core journals. Gupta and Karisiddappa (1998) in their paper analyze the growth of funded and collaborative research publications and authors as reflected in selected theoretical population genetics literature from 1956-60 to 1976-80. The study reveals that the focus of research is slowly shifting from internal collaboration to domestic and international collaboration, supported by increasing funding from govt. agencies in theoretical population genetics research.

Stem cells have the potential for medical treatment in the future, says, Ho et al. (2003). The authors determine the scientific productivity of stem cell research in the Asian Four Dragons (Hong Kong, Singapore, South Korea and Taiwan) from 1981 to 2001. Findings of the study reveal that South Korea's performance in stem cell research was especially outstanding.

Molatudi and Pouris (2006) review the use of bibliometric methods to analyze data on the performance of microbiology, genetics and molecular biology research over a 20 year period from 1980 to 2000. The study reveals that genetics and molecular biology publications have seen a steady decline. The lack of adequate output in these disciplines poses a threat to govt. policies and investment aimed at increasing biotechnology commercialization.

Patra and Mishra (2006) investigate some important characteristics of the bioinformetics literature through application of bibliometic techniques. The results of the study show that the bioinformetics literature is growing at an exponential rate. Li et al. (2009) evaluate the global scientific production of stem cell research. The mainstream research on stem cell was in hematology, oncology, and cell biology fields and the application of stem cell transplantation technology to human disease therapy, especially research related to 'embryonic stem cell' and 'mesenchymal stem cell' is the orientation of all the stem cell research in the 21st century.

Similar studies were also been conducted by many scientists. Malo and Geuna (2000) focus on issues concerning science and technology relationships posed by the emergency of a new drug discovery method, namely combinatorial chemistry and biology. Albert and Plaza (2004) analyze the impact of scientific publications produced by Spanish scientists working in Universities and other Public Research Centres (PRCs) located in the Region of Madrid in the development of Biotechnology. Jonkers (2010) explores the concentration in the global plant molecular life science research output.

Objectives

The main objectives of the study are to:

1. study the growth of cloning literature published during 1999-2010 as per the Web of Science ;
2. quantitative assessment of cloning literature by way of Relative Growth Rate (RGR) and Doubling Time (Dt.).
3. find out the subject dispersion and document type on cloning literature;
4. identify major contributing authors;
5. determine the highly cited journals;
6. examine the highly productive institutions; and
7. identify the highly productive countries.

Materials and Methods

The data was collected from the Web of Science database (1999-2010). The Web of Science is one of the most comprehensive databases covering all subjects. The keyword 'Cloning' has been used in the title option for extracting the number of records available in the above said database. The retrieved records were analyzed using spreadsheet application as per objectives of the study.

Results and Discussions

Year wise distribution of publications and citations

A total of 20,124 publications were published during 1999-2010 which received 2,51,574 citations. The highest number of publications (2505) was published in the year 1999 and publications have received 61,899 citations. The average number of publications published per year was 1677 and the average number of citations per year was 20,964.50. Table 1 and

Figure 1 give the year wise growth of publications and their citations. It is surprising to note that the declining trend in the number of publications in number of citations indicate that the quality and the quantity of research always go hand in hand. The older publications tend to receive more citations than the publications published recently which require sufficient time to attract more citations.

cloning literature was observed during 1999 to 2010. It was observed that more number of publications in a particular year received more

Table 1: Year-wise publications and citations of cloning research, 1999-2010

Year	Total Number of Publications (TP)	Total Number of Citations (TC)	Average Citations per Publication (ACP)
1999	2505	61899	24.71
2000	2268	48082	21.20
2001	2077	36965	17.80
2002	1813	24578	13.56
2003	1784	23778	13.33
2004	1584	16560	10.45
2005	1578	13702	8.68
2006	1481	10003	6.75
2007	1362	7615	5.59
2008	1236	4855	3.93
2009	1260	2786	2.21
2010	1176	751	0.64
Total	**20,124**	**2,51,574**	

Relative Growth Rate (RGR) and Doubling Time (Dt.)

The Relative Growth Rate (RGR) is the increase in number of articles per unit of time. This definition is derived from the definition of relative growth rates in the study of growth analysis of individual plants and effectively applied in the field of Botany (Hunt {1978 and 1982}; Poorter and Garnier, 1996; Hoffmann and Poorter, 2002. There exists a direct equivalence between the relative growth rate and the doubling time (Bradford, 1934). If the number of articles of a subject double during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. The relative growth rate (RGR) and doubling time (Dt.) of publications have been presented in Table 2. Figure-2 indicates the value of relative growth rate (RGR) of publications decreased from 0.65 in 2000 to 0.06 in 2010, simultaneously, the values of doubling time (Dt.) of publications increased from 1.06 in 2000 to 11.55 in 2010 (Figure-3) indicates that the research in the field of cloning has declined over a period of time.

Table 2: Relative Growth Rate (RGR) and Doubling Time (Dt.)

Year	Quantum of Output	Cumulative No. of output	W 1	W 2	R (P)	Dt. (P)
1999	2505	2505		7.82		
2000	2268	4773	7.82	8.47	0.65	1.06
2001	2077	6850	8.47	8.78	0.31	2.23
2002	1813	8663	8.78	9.06	0.28	2.47
2003	1784	10447	9.06	6.25	0.19	3.64
2004	1584	12031	6.25	6.39	0.14	4.95
2005	1578	13609	6.39	9.52	0.13	5.33
2006	1481	15090	9.52	9.62	0.10	6.93
2007	1362	16452	9.62	9.71	0.09	7.70
2008	1236	17688	9.71	9.78	0.07	9.90
2009	1260	18948	9.78	9.85	0.07	9.90
2010	1176	20124	9.85	9.91	0.06	11.55

Subject Dispersion of the cloning literature

The analysis of the 20,124 publications based on the subject distribution, provides a disciplinary profile of the cloning literature. Table 3 shows the multidisciplinary nature of the subject and the degree of the cloning literature is dispersed among many subjects. The cloning research is spread over as many as 50 subject areas. The subject, '*Biochemistry & Molecular Biology'* account for more than two thirds (2/3) of all the publications, 7300 (36.24 %), followed by '*Biochemistry & Applied Microbiology'* with 2988 (14.75 %) publications, '*Genetics & Heredity'* with 2196 (10.91 %) publications, '*Cell Biology'* with 1803 (8.96 %) publications, '*Biophysics*' with 1708 (8.48 %) publications, '*Microbiology*' with 1526 (7.58 %) publications, '*Plant Sciences*' with 1381 (6.86 %) publications, '*Immunology*' with 1278 (6.35 %) publications.

Table 3: Subject Dispersion of the cloning literature

Sl. No.	Subject Area	Rank	Number of Publications	Percentage (%)
1	Biochemistry & Molecular Biology	1	7300	36.24
2	Biotechnology & Applied Microbiology	2	2968	14.75
3	Genetics & Heredity	3	2196	10.91
4	Cell Biology	4	1803	8.96
5	Biophysics	5	1708	8.48
6	Microbiology	6	1526	7.58
7	Plant Sciences	7	1381	6.86
8	Immunology	8	1278	6.35
9	Zoology	9	743	3.69
10	Biochemical Research Methods	10	737	3.64
11	Veterinary Sciences	11	679	3.37
12	Endocrinology & Metabolism	12	632	3.14
13	Food Science & Technology	13	597	2.97
14	Pharmacology & Pharmacy	14	593	2.95
15	Biology	15	559	2.78
16	Multidisciplinary Sciences	16	547	2.72
17	Reproductive Biology	17	464	2.30
18	Developmental Biology	18	454	2.26
19	Applied Chemistry	19	423	2.10
20	Marine & Freshwater Biology	20	416	2.06
21	Neurosciences	21	388	1.93
22	Fisheries	22	374	1.86
23	Physiology	23	340	1.69
24	Entomology	24	334	1.66
25	Parasitology	25	328	1.63
26	Agriculture, Diary & Animal Science	26	296	1.47
27	Medicine, Research & Experimental	27	287	1.43
28	Hematology	28	281	1.39
29	Toxicology	29	220	1.09
30	Virology	30	182	0.90
31	Crystallography	31	177	0.88
32	Medicine, General & Internal	31	177	0.88
33	Mycology	33	165	0.82
34	Optics	34	152	0.75

35	Infectious Diseases	35	137	0.68
36	Gastroenterology & Hepatology	36	136	0.67
37	Physics, Atomic, Molecular & Chemical	37	128	0.64
38	Multidisciplinary Physics	37	128	0.64
39	Horticulture	39	127	0.63
40	Allergy	40	126	0.62
41	Multidisciplinary Agriculture	41	123	0.61
42	Agronomy	42	121	0.60
43	Ophthalmology	42	121	0.60
44	Multidisciplinary Chemistry	44	120	0.59
45	Peripheral Vascular Disease	45	110	0.54
46	Obstetrics & Gynecology	46	101	0.50
47	Medical Social Sciences	47	92	0.45
48	Ethics	48	78	0.38
49	Analytical Chemistry	49	73	0.36
50	Environmental Sciences	50	70	0.34

Distribution of Literature in Various Document Types

Table 4 illustrates the distribution of cloning literature in various document types. As common in many subjects, the single most prevalent form of publication is the research articles, which contributes 16,044 (79.72 %) of the total literature followed by meeting abstracts, with 2,461 (12.23 %) publications, proceedings papers, with 459 (2.28 %) publications and news items with 278 (1.38 %) publications.

Table 4: Distribution of document type of the cloning literature

Sl. No.	Document type	Number of Publications	Percentage	Cumulative Number of Publications
1	Research Articles	16,044	79.72	16044
2	Meeting Abstracts	2,461	12.23	18505
3	Proceedings Papers	459	2.28	18964
4	News Items	278	1.38	19242
5	Editorial Materials	276	1.37	19518
6	Reviews	220	1.09	19738
7	Corrections	201	0.99	19939
8	Letters	114	0.56	20053
9	Book Reviews	55	0.27	20108
10	Software Review	07	0.03	20115
11	Reprints	04	0.02	20119
12	Bibliography	03	0.01	20122
13	Biographical Item	01	0.004	20123
14	Poetry	01	0.004	20124
	Total	**20,124**	**100.00**	

Most productive authors

Table 5 lists the most productive authors of the cloning literature, the number of their publications, the period during which they have been contributing to the literature, and the yearly mean of author productivity. There are 30 top producing authors who contributed between 42 and 109. Zhang, Y. from People's Republic of China with 109 papers published (during 1999-2010) is the most productive author in the subject of cloning. He is the only author who published more than 100 papers. The second most productive author is Wang, L. from People's Republic of China who published 90 papers during 1999-2010, followed by Xie, Y. from People's Republic of China with 82 publications, Li Jing from People's Republic of China with 80 publications; Wang Yong from People's Republic of China with

75 papers ranks fourth and fifth respectively. A closer look at table 5 reveals that out of 30 top most authors, 21 authors are from People's Republic of China, 5 authors are from Japan, 2 authors each from the United States of America and South Korea. It reveals that the scientists from People's Republic of China are more productive and active in this field.

Table 5: Most Productive Authors

Sl. No.	Name of the Author	Country	Contribution Period	Total No. of Publications	Rank by TP	Yearly Mean	Rank by Yearly Mean
1	Zhang, Y	People's Republic of China	1999-2010	109	1	9.08	1
2	Wang, L.	People's Republic of China	1999-2010	90	2	7.50	5
3	Xie, Y.	People's Republic of China	2000-2010	82	3	7.45	6
4	Li, Jing	People's Republic of China	1999-2010	80	4	6.66	7
5	Wang, Yong	People's Republic of China	1999-2010	75	5	6.25	8
6	Liu, Yan	People's Republic of China	1999-2010	74	6	6.16	9
7	Lee, Jai-Heon	South Korea	1999-2010	72	7	6.00	11
8	Mao, Yumin	People's Republic of China	2001-2008	72	7	9.00	2
9	Tang, Kexuan	People's Republic of China	2003-2010	66	9	8.25	3
10	Yu, Li	USA	1999-2010	66	9	5.50	13
11	Li, Yong	People's Republic of China	1999-2010	65	11	5.42	14
12	Kim, Jeffrey H.	USA	1999-2010	63	12	5.25	15
13	Sun, Xiao Fang	People's Republic of China	2003-2010	62	13	7.75	4
14	Wang, Jun	People's Republic of China	1999-2010	62	13	5.16	16
15	Lee, Jin Seon	South Korea	1999-2010	57	15	4.75	19
16	Xu, Jin.	People's Republic of China	1999-2009	54	16	4.91	18
17	Chen, Jie	People's Republic of China	1999-2010	52	17	4.33	20
18	Lee, Jongwon	Japan	1999-2010	52	18	4.33	20
19	Ji, Chaoneng	People's Republic of China	1999-2008	51	19	5.10	17
20	Zhang, Lin	People's Republic of China	1999-2010	50	20	4.16	22
21	Gu, Shaohua	People's Republic of China	2001-2008	49	21	6.12	10
22	Aoki, Takashi	Japan	1999-2010	48	22	4.00	23

23	Suzuki, Makiko	Japan	1999-2009	48	22	4.00	23
24	Suzuki, Tomohiko	Japan	1999-2010	48	22	4.00	23
25	Li, Na	People's Republic of China	1999-2010	47	25	3.92	26
26	Zhang, H.	People's Republic of China	1999-2010	46	26	3.83	27
27	Ying, Kang	People's Republic of China	2001-2008	45	27	5.62	12
28	Zhang, Jie	People's Republic of China	1999-2010	45	27	3.75	28
29	Liu, Jun	People's Republic of China	1999-2010	42	29	3.50	29
30	Nagahama, Yoshitaka	Japan	1999-2010	42	29	3.50	29

TP – Total Publications

Highly Productive Journals in Cloning Research

The distributions of publications on cloning literature were spread over a variety of publication media. Table 6 provides the list of 40 core journals and number of articles published by each journal. *The Journal of Biological Chemistry* is the largest contributor (699) to the journal literature on cloning literature (1999-2010) and *Biochemical and Biophysical Research Communications* is the second one with 560 articles. Other three most productive journals, namely, *Gene* (462 articles), *FASEB Journal* (354 articles) and *Bioscience, Biotechnology and Biochemistry* (306 articles) journals rank third, fourth and fifth respectively. It is interesting to note that 28 journals are published from USA and UK.

Table 6: Highly Productive Journals in cloning literature during 1999-2010

Rank	Name of the Journal	Number of Publications	Rank by TP	Country
1	*Journal of Biological Chemistry*	699	1	USA
2	*Biochemical and Biophysical Research Communications*	560	2	USA
3	*Gene*	462	3	Netherlands
4	*FASEB Journal*	354	4	USA
5	*Bioscience Biotechnology and Biochemistry*	306	5	Japan
6	*Biochemica Et Biophysica Acta-Gene Structure and Expression*	270	6	Netherlands
7	*DNA Sequence*	240	7	USA
8	*Comparative Biochemistry and Physiology B-Biochemistry & Molecular Biology*	219	8	USA
9	*Fish & Shell Fish Immunology*	216	9	England
10	*Genomics*	215	10	USA
11	*Applied and Environmental Microbiology*	212	11	USA
12	*Protein Expression and Purification*	200	12	USA
13	*FEMS Microbiology Letters*	195	13	USA
14	*General and Comparative Endocrinology*	185	14	USA
15	*European Journal of Biochemistry*	183	15	England
16	*Biochemical Journal*	168	16	England
17	*Molecular Biology Reports*	167	17	Netherlands
18	*Applied Microbiology and Biotechnology*	163	18	USA

19	*Plant and Cell Physiology*	161	19	England
20	*Acta Biochemica Et Biophysica Sinica*	151	20	England
21	*Biology of Reproduction*	150	21	USA
22	*Veterinary Immunology and Immuno Pathology*	148	22	Netherlands
23	*Biotechnology Letters*	141	23	Netherlands
24	*Journal of Bacteriology*	129	24	USA
25	*Acta Crystallographica Section F-Structural Biology and Crystallization Communication*	127	25	USA
26	*Proceedings of the National Academy of Sciences of the United States of America*	123	26	USA
27	*Journal of Microbiology and Biotechnology*	120	27	South Korea
28	*Physical Review A*	120	27	USA
29	*Insect Biochemistry and Molecular Biology*	117	29	England
30	*FEBS Letters*	113	30	Netherlands
31	*Blood*	111	31	USA
32	*Journal of Bioscience and Bioengineering*	107	32	Japan
33	*Plant Science*	106	33	Ireland
34	*Archives of Biochemistry and Biophysics*	103	34	USA
35	*Molecular and Biochemical Parasitology*	103	34	Netherlands
36	*Plant Physiology*	101	36	USA
37	*Zoological Science*	100	37	Japan
38	*Investigative Ophthalmology & Visual Science*	99	38	USA
39	*Developmental and Comparative Immunology*	98	39	England
40	*Current Microbiology*	96	40	USA

TP-Total Publications

Institution productivity distribution of cloning literature

There were more than 1500 institutions involved in the research activity in the field of cloning. Table 7 provides productivity of top 50 institutions. *The Chinese Academy of Science* (People's Republic of China) topped the list with 570 publications followed by *University of Tokyo* (Japan) with 450 publications and *Fudan University* (People's Republic of China) with 296 publications.

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Table 7: Institution productivity distribution of cloning literature

Sl. No.	Name of the Institution	No. of publications	Rank by TP	Country
1	Chinese Acad. Science	570	1	People's Republic of China
2	University of Tokyo	450	2	Japan
3	Fudan University	296	3	People's Republic of China
4	Kyoto University	251	4	Japan
5	Osaka University	203	5	Japan
6	Harvard University	201	6	USA
7	Hokkaido University	198	7	Japan
8	Seoul National University	175	8	South Korea
9	University of Texas	171	9	USA
10	Academia Sinica	144	10	Taiwan
11	Nagoya University	139	11	Japan
12	Chinese Academy of Agricultural Sciences	135	12	People's Republic of

				China
13	Institut National de la Recherche Agronomique (INRA)	130	13	France
14	Tohoku University	130	13	Japan
15	China Agricultural University	122	15	People's Republic of China
16	Cornell University	122	16	USA
17	Kyushu University	118	17	Japan
18	National Taiwan University	115	18	Taiwan
19	Shanghai Jiao Tong University	113	19	People's Republic of China
20	Zhejiang University	108	20	People's Republic of China
21	Rikagaku Kenkyujo (RIKEN)	105	21	Japan
22	CSIC (Consejo Superior de Investigaciones Cientificas)	101	22	Spain
23	University of Illinois	98	23	USA
24	University of Washington	97	24	USA
25	Yale University	97	24	USA
26	Russian Academy of Sciences	96	26	Russia
27	University of Florida	96	26	USA
28	Hiroshima University	95	28	USA
29	Nanjing Agricultural University	94	29	People's Republic of China
30	Okayama University	93	30	Japan
31	University of Michigan	92	31	USA
32	University of Toronto	92	31	Canada
33	CNRS (Centre National de la recherche scientifique)	91	33	France
34	USDA Agricultural Research Service	89	34	USA
35	Johns Hopkins University	88	35	USA
36	National Institute of Agro biological Sciences	88	35	Japan
37	University of Maryland	87	37	USA
38	Huazhong Agricultural University	86	38	People's Republic of China
39	University of California San Francisco	86	38	USA
40	University of Wisconsin – Madison	86	38	USA
41	University of California Davis	85	41	USA
42	University of Pennsylvania	85	41	USA
43	Sichuan University	84	43	People's Republic of China
44	University California Los Angeles	83	44	USA
45	University of Tsukuba	83	44	Japan
46	McGill University	82	46	Canada
47	Kitasato University	80	47	Japan
48	National University of Singapore	79	48	Singapore
49	NCI (National Cancer Institute)	79	48	USA
50	Chonnam National University	77	50	Korea

TP-Total Publications

Country- wise distribution of cloning literature

Table 8 provides the list of 50 most productive countries. USA topped the list with 5571 publications

followed by Japan with 3799 publications, People's Republic of China with 3170 publications, Germany with 1248 publications and South Korea with 1064 publications. Only 10 countries have contributed more than 90 percent of the publications in the field .

Table 8: Country-wise distribution of cloning literature with TP, TC and ACP

Rank by No. of publications	Rank by ACP	Country	Total No.of publications (TP)	Total No.of citations(TC)	Average No. of Citations per publication (ACP)
1	11	USA	5571	99,172	17.80
2	19	Japan	3799	54,388	14.32
3	45	People's Republic of China	3170	15,553	4.91
4	10	Germany	1248	22,343	17.90
5	39	South Korea	1064	6,800	6.39
6	8	France	840	15,251	18.16
7	7	England	798	14,720	18.45
8	18	Canada	760	11,630	15.30
9	20	Italy	487	6,936	14.24
10	16	Spain	480	7,382	15.38
11	46	India	433	2,095	4.84
12	23	Australia	368	4,935	13.41
13	27	Taiwan	359	3,209	8.94
14	5	Sweden	278	5,687	20.46
15	28	Brazil	262	2320	8.85
16	6	Netherlands	256	5,111	19.96
17	2	Belgium	243	5748	23.65
18	3	Scotland	226	4837	21.40
19	1	Switzerland	220	5417	24.62
20	9	Denmark	193	3495	18.11
21	41	Russia	163	991	6.08
22	12	Austria	137	2293	16.74
23	4	Israel	136	2835	20.85
24	33	Mexico	118	966	8.19
25	36	Thailand	115	827	7.19
26	40	Poland	111	700	6.31
27	17	Finland	100	1534	15.34
27	50	Iran	100	225	2.25
27	15	Norway	100	1604	16.04
30	22	Singapore	93	1280	13.76
31	21	Portugal	90	1253	13.92
32	24	Czech Republic	87	1075	12.36
33	31	Greece	85	704	8.28
34	14	New Zealand	77	1256	16.31
35	29	Argentina	66	582	8.82
36	34	Hungary	62	485	7.82
36	42	Turkey	62	315	5.08
38	25	South Africa	59	675	11.44
39	32	Ireland	56	810	8.27
39	13	Wales	56	919	16.41

41	38	North Ireland	45	295	6.56
42	47	Chile	38	169	4.45
43	35	Tunisia	37	372	7.35
44	26	Slovakia	29	263	9.07
45	43	Malaysia	25	125	5.00
45	49	Pakistan	25	60	2.40
47	48	Egypt	24	85	3.54
48	37	Venezuela	19	125	6.58
49	30	Croatia	15	127	8.47
50	44	Colombia	13	65	5.00

Conclusion

The present study analyses the cloning publications across the world for the period 1999-2010 based on the Web of Science database. A total of 20,124 publications were published during 1999-2010 which received 2,51,574 citations. The highest number of publications (2505) was published in the year 1999 which received 61,899 citations.

It is evident from the study that there is a decline in the number of publications per year. The important reasons to mention here are: several cloned animals have died prematurely from infections and other complications. Scientists opine that in spite of recent technological advances, animal cloning remains extremely inefficient and has low success rate. For every 100 experiments only one or two cases appear to produce a viable offspring in surrogate mothers. The same problems would be expected in human cloning. In addition, scientists do not know how cloning could impact mental development. Many social, moral and ethical arguments have been raised opposition to clone human beings.

On the other hand, Japanese studies have shown that cloned mice live in poor health and die early; Australia's first cloned sheep appeared healthy and energetic on the day she died; In February 1997, the President of USA, Clinton issued an executive order prohibiting the use of federal funds for human cloning; In 2001 US policy makers secured a ban on human cloning. Since 2003 articles on cloning and related subjects less appeared in journals and thus there is a decline in the number of publications per year.

Scientometric studies enable the science policy makers and administrators to understand and grasp the growth, development and impact of research and to know the countries, institutions and the individual scientists who are active in a particular field of research activity (Kademani, Sagar and Bhanumurthy, 2011).

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