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A Scientometric Study on Neuroanatomy Literature

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Abstract **- The contributions of literature in the field of Neuroanatomy in MEDLINE database which covered in PubMed is discussed in this paper. The literature covered in the database all through the years i.e. 1980-2019 was taken into consideration for this study. MEDLINE concealed the maximum of 9350 records in the field of Neuroanatomy. The United States is the prime publisher in the field of Neuroanatomy literature as per this study. 96.33% of records covered in English language in this analysis. There is a fluctuation trend in the study of Relative Growth Rate (RGR) and also in Doubling time (Dt) when calculated by year-wise. A complete of 85.71% of papers is written by way of multi-authors. The ratio represents the single and multi-authors' papers is 1:7 in the area of Neuroanatomy literature. It was determined that meager percent i.e. 0.46% of records represent nameless authorship. The year-wise Degree of Collaboration shows the ratio in-between 0.38 to 0.94 in the field of Neuroanatomy literature. The Co-Authorship Index (CAI) for greater than two authors' papers was lower in the first, second, and third blocks and enriched in the fourth block in this study. The average Collaborative Co-efficient (CC) has been arrived at 0.55 which indicates huge wide variety of contributions became by multiple authors papers in the subject of Neuroanatomy literature. The total study exposed that the multi-authors' papers are lead in the Neuroanatomy research. It additionally indicates that the collaboration in Neuroanatomy research is in a growing trend in current years.**
Keywords: **Scientometrics, Neuroanatomy, Relative Growth Rate (RGR), Doubling time (Dt), Degree of Collaboration (DC), Co-Authorship Index (CAI), Collaborative Co-efficient (CC)**

1. INTRODUCTION

Scientometrics is dealing with the quantifying the written communication, which allows to calculate the published knowledge. It helps to calculate the growth of literature, productivity, authorship pattern, and degree of collaboration, pattern of collection building, and their use [1].

Scientometrics/Bibliometric techniques are actually being observed and with the end result, it has been visible that one-fourth of all the articles published in Library and Information Science Periodicals are on Scientometrics/ Bibliometrics and its associated topics [2]. In this study an attempt has been made to find the contributions of literature in the field of Neuroanatomy (1980-2019) in MEDLINE database which included in PubMed.

II. NEUROANATOMY

Neuroanatomy is the study of the structure and organization of the nervous system. In vertebrates, the nervous system is segregated into the internal structure of the brain and spinal cord and the routes of the nerves that connect to the rest of the body [3].

III. LITERATURE REVIEW

Huge numbers of studies are conducted to analyze the author collaboration output of contributions, which will identify the areas of research activity, authorship pattern, citation impact factor and other bibliometric indicators. Macias-Chapula analyzed the patterns of the growth in AIDS literature, as well as the types of documents published, authorship pattern, institutional affiliations of authors, and subject content [4].

Hartinah *et al.*, [15] studied on nutrition problems in Indonesia, and discussed the authorship pattern, institutional affiliation, and the half-life of the literature on nutrition.

Divya Srivastava [6] studied the concept of collaboration and the methodology followed in studying research collaboration in the field of Biomedical Sciences in India.

Ramesh Babu, and Ramakrishnan analyzed the Growth of Literature, Bradford Law of Scattering and National Patterns of Research output and priorities in Hepatitis in their studies [7-9].

The evaluate of literature on scientometrics research in the field of medicine showed that so far no quantitative study on literature on Neuroanatomy was carried out. So the present study performed in the area of Neuroanatomy.

IV. OBJECTIVES OF THE STUDY

The objectives of this examine are

1. To reveal the growth of literature on Neuroanatomy.
2. To categorize the publication types included by literature on Neuroanatomy.
3. To scrutinize the languages covered by way of literature on Neuroanatomy.

4. To categorize the countries covered in the discipline of literature on Neuroanatomy.
5. To study the level of authorship pattern i.e. Single Vs. Multiple authors, Degree of Collaboration (DC), Pattern of Co-Authorship Index (CAI), and Collaborative Co-efficient (CC) in field of literature on Neuroanatomy.

V. METHODOLOGY

The records covered for the duration of the year 1980 to 2019 in the discipline of Neuroanatomy in MEDLINE database which have been covered in the PubMed (https://pubmed.ncbi.nlm.nih.gov) have been searched and the information were collected. The retrieved records from the source database had been modified into FoxPro and loaded in SPSS.

The keyword 'Neuroanatomy' has applied for gathering the variety of information available in MEDLINE database. The records, accumulated from the source database has analyzed by way of the usage of the bibliometric method such as Relative Growth Rate (RGR) [10-11], Doubling time (Dt) [12], Degree of Collaboration (DC) [13], Co-Authorship Index (CAI) [14], and Collaborative Co-efficient (CC) [15] in the discipline of Neuroanatomy.

VI. ANALYSIS AND DISCUSSION

A. Quantum of Literature Published in Neuroanatomy by Year-Wise

A total of 9350 records covered in MEDLINE database in the discipline of Neuroanatomy has been given in Table I. It is found from the table that there is a gradual growth of literature in the subject of study by year after year except some years. It indicates the fluctuation trend of growth of literature in the area of Neuroanatomy. The year 2018 has marked a maximum record of 638 out of overall productivity in the study duration.

B. Quantum of Neuroanatomy Research Output According to Country

The country-wise production of the Neuroanatomy records was given in table II. It is found that the United States is the primary producer, followed through England, Netherlands, Germany, and Switzerland and so on.

The literary production is noticed in nearly all of the important countries covered in the field of Neuroanatomy. It additionally indicates that the Indian contributions have been eight records with 0.09 % of total output.

TABLE I QUANTUM OF LITERATURE PUBLISHED IN NEUROANATOMY BY YEAR-WISE

Sl. No.	Year	No. of Records	%	Cumulative %
1	1980	29	0.3	0.3
2	1981	25	0.3	0.6
3	1982	26	0.3	0.9
4	1983	38	0.4	1.3
5	1984	45	0.5	1.7
6	1985	49	0.5	2.3
7	1986	56	0.6	2.9
8	1987	73	0.8	3.6
9	1988	117	1.3	4.9
10	1989	119	1.3	6.2
11	1990	139	1.5	7.7
12	1991	125	1.3	9
13	1992	121	1.3	10.3
14	1993	120	1.3	11.6
15	1994	131	1.4	13
16	1995	160	1.7	14.7
17	1996	152	1.6	16.3
18	1997	147	1.6	17.9
19	1998	169	1.8	19.7
20	1999	188	2	21.7
21	2000	209	2.2	23.9
22	2001	199	2.1	26.1
23	2002	220	2.4	28.4
24	2003	228	2.4	30.9
25	2004	262	2.8	33.7
26	2005	239	2.6	36.2
27	2006	286	3.1	39.3
28	2007	313	3.3	42.6
29	2008	325	3.5	46.1
30	2009	322	3.4	49.5
31	2010	298	3.2	52.7
32	2011	320	3.4	56.1
33	2012	350	3.7	59.9
34	2013	370	4	63.9
35	2014	493	5.3	69.1
36	2015	517	5.5	74.7
37	2016	552	5.9	80.6
38	2017	585	6.3	86.8
39	2018	638	6.8	93.6
40	2019	595	6.4	100
Total		9350	100	

TABLE II COUNTRIES VS RECORDS IN THE FIELD OF NEUROANATOMY

Sl. No.	Country	Records	Percentage
1	United States	3069	32.82
2	England	1098	11.74
3	Netherlands	848	9.07
4	Germany	603	6.45
5	Switzerland	170	1.82
6	Ireland	151	1.61
7	France	123	1.32
8	Italy	105	1.12
9	Austria	90	0.96
10	Japan	82	0.88
11	Spain	66	0.71
12	Poland	44	0.47
13	China	27	0.29
14	Russia (Federation)	27	0.29
15	Denmark	19	0.20
16	Hungary	19	0.20
17	Scotland	17	0.18
18	United Arab Emirates	16	0.17
19	Australia	15	0.16
20	Brazil	15	0.16
21	Canada	11	0.12
22	Belgium	10	0.11
23	Argentina	8	0.09
24	India	8	0.09
25	Romania	7	0.07
26	Sweden	7	0.07
27	Boca Raton (FL)	6	0.06
28	Greece	6	0.06
29	Turkey	6	0.06
30	Czech Republic	5	0.05
31	Norway	5	0.05
32	Finland	4	0.04
33	Mexico	4	0.04
34	New Zealand	4	0.04
35	Portugal	4	0.04
36	China (Republic: 1949-)	3	0.03
37	Croatia	3	0.03
38	Iran	3	0.03
39	Korea (South)	3	0.03
40	Bangladesh	2	0.02
41	Singapore	2	0.02
42	South Africa	2	0.02
43	Bosnia and Herzegovina	1	0.01
44	Bulgaria	1	0.01

45	Colombia	1	0.01
46	Israel	1	0.01
47	Kenya	1	0.01
48	Pakistan	1	0.01
49	Puerto Rico	1	0.01
50	Salt Lake City (UT)	1	0.01
51	Serbia	1	0.01
52	Slovakia	1	0.01
53	Thailand	1	0.01
54	Ukraine	1	0.01
55	Uruguay	1	0.01
56	Not Mentioned	2620	28.02
Total		9350	100.00

C. Distribution of Publication Types in the Literature of Neuroanatomy

Table III shows that the types of contributions included in the subject of Neuroanatomy. A total of 33.28% covered by the Research Support, Non-U.S. Gov't; followed by Journal Article (28.79%), Review (20.62%), Research Support, U.S. Gov't, P.H.S. (7.27%), Portrait (2.55%), Research Support, N.I.H., Extramural (1.93%), Research Support, U.S. Gov't, Non-P.H.S. (1.91%), Letter (0.59%), Editorial (0.49), and Video-Audio Media (0.27%). The remaining 2.3% have been from Other Publication Types covered within the MEDLINE database.

TABLE III DISTRIBUTION OF PUBLICATION TYPES IN THE LITERATURE OF NEUROANATOMY

Sl. No.	Publication Type	No. of Records	%	Cumulative %
1	Research Support, Non-U.S. Gov't	3112	33.28	33.28
2	Journal Article	2692	28.79	62.07
3	Review	1928	20.62	82.70
4	Research Support, U.S. Gov't, P.H.S.	680	7.27	89.97
5	Portrait	238	2.55	92.51
6	Research Support, N.I.H., Extramural	180	1.93	94.44
7	Research Support, U.S. Gov't, Non-P.H.S.	179	1.91	96.35
8	Letter	55	0.59	96.94
9	Editorial	46	0.49	97.43
10	Video-Audio Media	25	0.27	97.70
11	Systematic Review	24	0.26	97.96
12	Research Support, N.I.H., Intramural	23	0.25	98.20
13	Validation Study	20	0.21	98.42
14	Introductory Journal Article	19	0.20	98.62
15	Published Erratum	18	0.19	98.81
16	Case Reports	17	0.18	98.99
17	News	14	0.15	99.14
18	Randomized Controlled Trial	13	0.14	99.28
19	Historical Article	12	0.13	99.41
20	Other Publication Types	55	0.59	100.00
Total		9350	100.00	

D. Distribution of Languages in the Literature of Neuroanatomy

Table IV indicates the distribution of citations according to language in the course of study period i.e. from the year 1980 to 2019. The table shows that out of a total of 9350 records, a complete of 9007 records had been in English language forming 96.33% of the whole. The following other languages are German, Spanish, French, Japanese, Russian, Chinese, and many others.

TABLE-IV DISTRIBUTION OF LANGUAGES IN THE LITERATURE OF NEUROANATOMY

Sl. No.	Language	No. of Records	%	Cumulative %
1	English	9007	96.33	96.33
2	German	69	0.74	97.07
3	Spanish	64	0.68	97.75
4	French	50	0.53	98.29
5	Japanese	46	0.49	98.78
6	Russian	28	0.30	99.08
7	Chinese	25	0.27	99.35
8	Italian	10	0.11	99.45
9	Hungarian	9	0.10	99.55
10	Portuguese	7	0.07	99.63
11	Dutch	6	0.06	99.69
12	Danish	4	0.04	99.73
13	Swedish	4	0.04	99.78
14	Czech	3	0.03	99.81
15	Finnish	3	0.03	99.84
16	Norwegian	3	0.03	99.87
17	Polish	3	0.03	99.90
18	Bulgarian	1	0.01	99.91
19	Hebrew	1	0.01	99.93
20	Croatian	1	0.01	99.94
21	Korean	1	0.01	99.95
22	Lithuanian	1	0.01	99.96
23	Romanian	1	0.01	99.97
24	Slovak	1	0.01	99.98
25	Serbian	1	0.01	99.99
26	Turkish	1	0.01	100.00
	Total	9350	100.00	

VII. RELATIVE GROWTH RATE (RGR) AND DOUBLING TIME (Dt)

The evaluation of data at the literary output in Neuroanatomy has been accomplished with parameters including Relative Growth Rate (RGR) and Doubling time (Dt).

A. RGR and Dt for Neuroanatomy Output by Year-Wise

It is seen from Table V that there is a fluctuation trend in the Relative Growth Rate (RGR) by year-wise. The Relative Growth Rate (RGR) has been lowering from the year 1981 (0.62) to 2019 (0.06). However the RGR by year-wise exposed a fluctuation trend (Figure 1). The Doubling Time (Dt) has also proven a fluctuation trend when calculated by year-wise. Normally the doubling time always is in an increasing trend. But the data in table 5 exposes fluctuation in different years. Of course, the Doubling time (Dt) increases from 1.12 in the year 1981 to 2019 (10.98) however it is also in a fluctuation trend in the study period (Figure 2).

TABLE V RGR AND DT FOR NEUROANATOMY RESEARCH

Year	Quantum of Output	Cumulative Total of Output	W_1	W_2	$1 - 2^{\overline{R}(aa^{-1}\ year^{-1})}$ RGR	Dt(a)
1980	29	29		3.37		
1981	25	54	3.37	3.99	0.62	1.12
1982	26	80	3.99	4.38	0.39	1.77
1983	38	118	4.38	4.77	0.39	1.77
1984	45	163	4.77	5.09	0.32	2.14
1985	49	212	5.09	5.36	0.27	2.60
1986	56	268	5.36	5.59	0.23	3.00
1987	73	341	5.59	5.83	0.24	2.87
1988	117	458	5.83	6.13	0.30	2.33
1989	119	577	6.13	6.36	0.23	3.04
1990	139	716	6.36	6.57	0.21	3.24
1991	125	841	6.57	6.73	0.16	4.21
1992	121	962	6.73	6.87	0.14	4.99
1993	120	1082	6.87	6.99	0.12	5.95
1994	131	1213	6.99	7.10	0.11	6.25
1995	160	1373	7.1	7.22	0.12	5.55
1996	152	1525	7.22	7.33	0.11	6.31
1997	147	1672	7.33	7.42	0.09	7.55
1998	169	1841	7.42	7.52	0.10	7.07
1999	188	2029	7.52	7.62	0.10	7.27
2000	209	2238	7.62	7.71	0.09	7.42
2001	199	2437	7.71	7.80	0.09	7.83
2002	220	2657	7.8	7.88	0.08	8.16
2003	228	2885	7.88	7.97	0.09	7.94
2004	262	3147	7.97	8.05	0.08	8.23
2005	239	3386	8.05	8.13	0.08	8.95
2006	286	3672	8.13	8.21	0.08	8.83
2007	313	3985	8.21	8.29	0.08	8.63
2008	325	4310	8.29	8.37	0.08	8.81
2009	322	4632	8.37	8.44	0.07	9.80
2010	298	4930	8.44	8.50	0.06	10.98
2011	320	5250	8.5	8.57	0.07	10.50
2012	350	5600	8.57	8.63	0.06	11.45
2013	370	5970	8.63	8.69	0.06	10.74
2014	493	6463	8.69	8.77	0.08	8.26
2015	517	6980	8.77	8.85	0.08	8.58
2016	552	7532	8.85	8.93	0.08	9.01
2017	585	8117	8.93	9.00	0.07	9.66
2018	638	8755	9	9.08	0.08	8.96
2019	595	9350	9.08	9.14	0.06	10.98

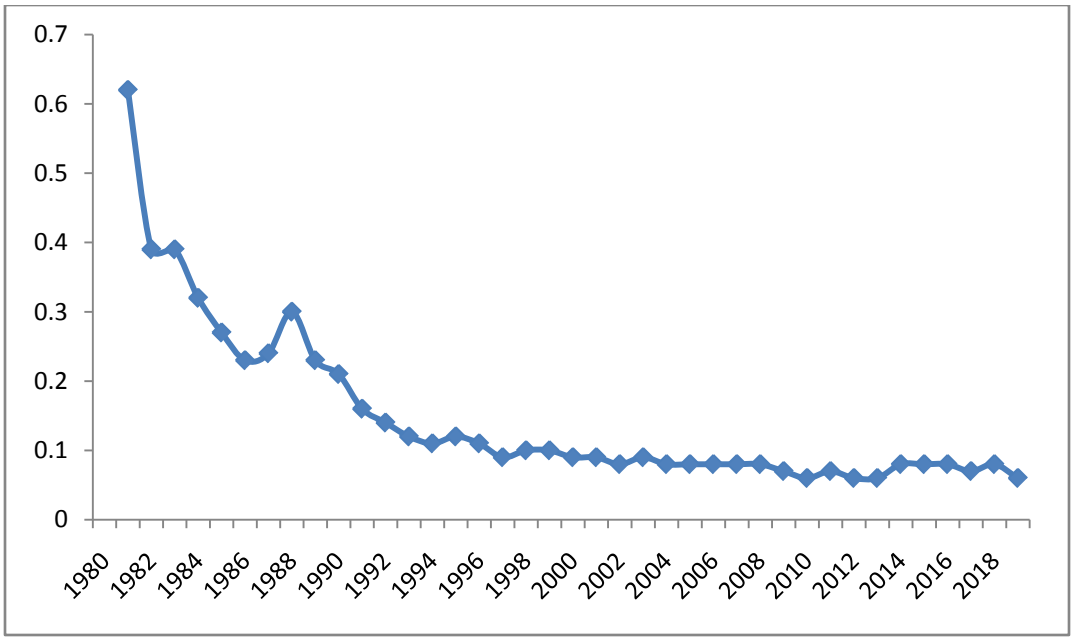

Fig. 1 Relative Growth Rate (RGR) for Neuroanatomy Research

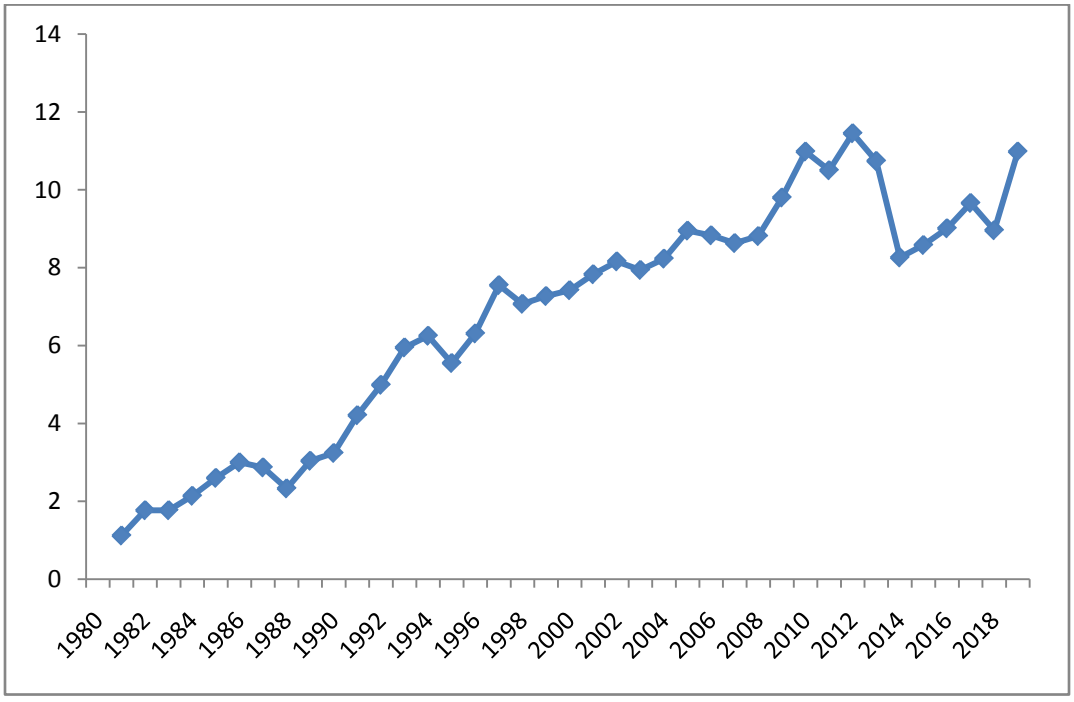

Fig. 2 Doubling time (Dt) for Neuroanatomy Research

VIII. AUTHORSHIP PATTERN

This paper also is to study the level of authorship pattern. i.e. Single Vs. Multiple authors, Degree of Collaboration (DC), Pattern of Co-Authorship Index (CAI), and Collaborative Co-efficient (CC).

A. Authorship Pattern of Neuroanatomy Research

Table-VI shows that the authorship pattern of research output of Neuroanatomy literature. The multi-authors' papers occupied the major percentage in this study. A complete of 85.71% of papers is written by multi-authors. The ratio represents that the single and multi-authors' papers is 1:7 in the area of Neuroanatomy. It was understood from the table that meager percent i.e. 0.46% of records represent nameless authorship. The high rate of contributions by multi-authors' papers is the phenomenon of scientific research which is also proved by means of variety of authors in their unique research. (Figure 3).

TABLE VI SINGLE VS MULTI AUTHORED CONTRIBUTIONS IN NEUROANATOMY RESEARCH

Year	Anonymous		Single Authored		Multi Authored		Total	%
	Contributions	%	Contributions	%	Contributions	%		
1980	0	0.00	18	1.39	11	0.14	29	0.3
1981	2	4.65	12	0.93	11	0.14	25	0.3
1982	2	4.65	12	0.93	12	0.15	26	0.3
1983	2	4.65	20	1.55	16	0.20	38	0.4
1984	2	4.65	17	1.31	26	0.32	45	0.5
1985	2	4.65	20	1.55	27	0.34	49	0.5
1986	1	2.33	20	1.55	35	0.44	56	0.6
1987	2	4.65	22	1.70	49	0.61	73	0.8
1988	2	4.65	23	1.78	92	1.15	117	1.3
1989	1	2.33	23	1.78	95	1.19	119	1.3
1990	2	4.65	25	1.93	112	1.40	139	1.5
1991	2	4.65	26	2.01	97	1.21	125	1.3
1992	2	4.65	36	2.78	83	1.04	121	1.3
1993	0	0.00	27	2.09	93	1.16	120	1.3
1994	0	0.00	28	2.17	103	1.29	131	1.4
1995	1	2.33	29	2.24	130	1.62	160	1.7
1996	3	6.98	28	2.17	121	1.51	152	1.6
1997	1	2.33	37	2.86	109	1.36	147	1.6
1998	1	2.33	27	2.09	141	1.76	169	1.8
1999	0	0.00	32	2.47	156	1.95	188	2
2000	1	2.33	26	2.01	182	2.27	209	2.2
2001	0	0.00	33	2.55	166	2.07	199	2.1
2002	1	2.33	50	3.87	169	2.11	220	2.4
2003	1	2.33	39	3.02	188	2.35	228	2.4
2004	0	0.00	44	3.40	218	2.72	262	2.8
2005	1	2.33	36	2.78	202	2.52	239	2.6
2006	0	0.00	43	3.33	243	3.03	286	3.1
2007	1	2.33	46	3.56	266	3.32	313	3.3
2008	1	2.33	40	3.09	284	3.54	325	3.5
2009	2	4.65	38	2.94	282	3.52	322	3.4
2010	0	0.00	43	3.33	255	3.18	298	3.2
2011	1	2.33	36	2.78	283	3.53	320	3.4
2012	1	2.33	39	3.02	310	3.87	350	3.7
2013	1	2.33	50	3.87	319	3.98	370	4
2014	1	2.33	47	3.63	445	5.55	493	5.3
2015	0	0.00	41	3.17	476	5.94	517	5.5
2016	2	4.65	41	3.17	509	6.35	552	5.9
2017	1	2.33	37	2.86	547	6.83	585	6.3
2018	0	0.00	36	2.78	602	7.51	638	6.8
2019	0	0.00	46	3.56	549	6.85	595	6.4
Total	43	100.00	1293	100.00	8014	100.00	9350	100.00

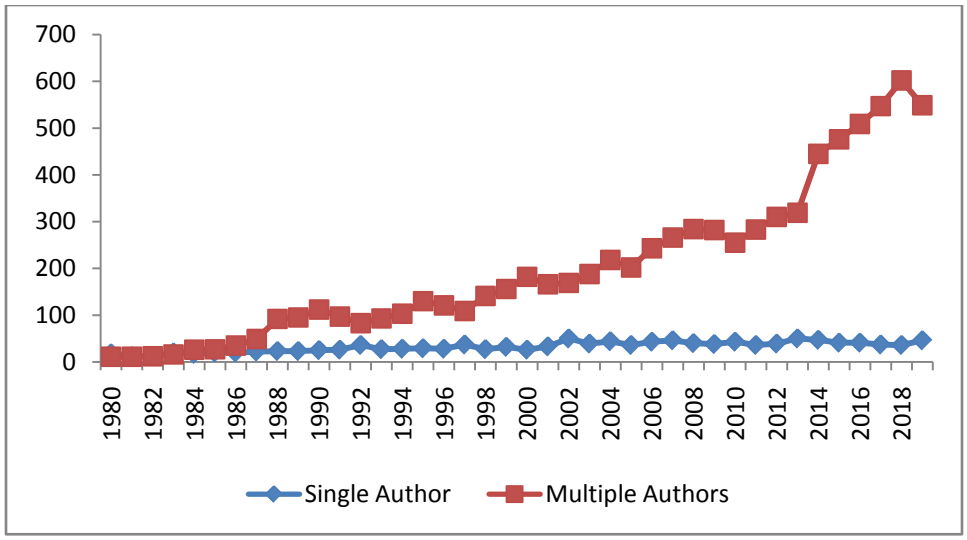

Fig. 3 Single Vs. Multi authored contributions in Neuroanatomy Research

B. Degree of Collaboration in Neuroanatomy Research

The Degree of Collaboration in the area of Neuroanatomy has been measured with the assist of the method made by K. Subramaniam. Subsequently, the Degree of Collaboration has been measured for the year 1980. It is given below:

$$C = \frac{11}{11 + 18} = \frac{11}{29} = 0.38$$

Similarly, the Degree of Collaboration is calculated for every year and presented in Table VII. It is seen from the table that the year-wise Degree of Collaboration shows the ratio in-between 0.38 to 0.94 in the study of the degree of collaboration in the field of Neuroanatomy. The year-wise Degree of Collaboration falls more than 0.5 and showing that the multi-authors' contributions are more in the subject of Neuroanatomy.

TABLE VII DEGREE OF COLLABORATION IN NEUROANATOMY RESEARCH

Year	Anonymous	Single Author	Two Authors	Three Authors	Four Authors	Five Authors	More Than Five Authors	Total	More Than One Author	Degree of Collaboration
1980	0	18	7	2	2	0	0	29	11	0.38
1981	2	12	3	6	2	0	0	25	11	0.48
1982	2	12	4	5	0	1	2	26	12	0.50
1983	2	20	9	4	2	1	0	38	16	0.44
1984	2	17	11	8	3	2	2	45	26	0.60
1985	2	20	14	6	3	3	1	49	27	0.57
1986	1	20	17	9	4	4	1	56	35	0.64
1987	2	22	23	11	8	4	3	73	49	0.69
1988	2	23	38	18	18	4	14	117	92	0.80
1989	1	23	45	22	16	6	6	119	95	0.81
1990	2	25	41	36	18	7	10	139	112	0.82
1991	2	26	27	32	19	8	11	125	97	0.79
1992	2	36	34	22	11	11	5	121	83	0.70
1993	0	27	20	30	15	9	19	120	93	0.78
1994	0	28	22	31	21	13	16	131	103	0.79
1995	1	29	41	24	24	16	25	160	130	0.82
1996	3	28	37	28	25	12	19	152	121	0.81
1997	1	37	34	32	17	8	18	147	109	0.75
1998	1	27	38	34	19	21	29	169	141	0.84
1999	0	32	38	34	28	21	35	188	156	0.83

2000	1	26	43	35	35	21	48	209	182	0.88
2001	0	33	36	25	15	33	57	199	166	0.83
2002	1	50	35	37	24	13	60	220	169	0.77
2003	1	39	49	32	28	25	54	228	188	0.83
2004	0	44	41	31	32	35	79	262	218	0.83
2005	1	36	30	33	36	37	66	239	202	0.85
2006	0	43	53	44	33	31	82	286	243	0.85
2007	1	46	54	54	40	39	79	313	266	0.85
2008	1	40	66	55	33	39	91	325	284	0.88
2009	2	38	79	36	37	34	96	322	282	0.88
2010	0	43	59	45	38	29	84	298	255	0.86
2011	1	36	53	43	46	38	103	320	283	0.89
2012	1	39	49	51	39	41	130	350	310	0.89
2013	1	50	51	55	41	45	127	370	319	0.86
2014	1	47	60	65	64	63	193	493	445	0.90
2015	0	41	63	57	70	55	231	517	476	0.92
2016	2	41	63	60	61	71	254	552	509	0.93
2017	1	37	67	49	82	65	284	585	547	0.94
2018	0	36	70	68	70	66	328	638	602	0.94
2019	0	46	55	46	60	55	333	595	549	0.92
Total	43	1293	1579	1315	1139	986	2995	9350	8014	0.86

C. The Pattern of Co-Authorship Index (CAI) in the Discipline of Neuroanatomy

The method of Co-Authorship Index (CAI) has been employed to study the patterns of co-authors in the field of Neuroanatomy Research from the year 1980 to 2019. For the motive of measuring Co-Authorship Index (CAI) the entire information set was divided into four blocks. Consequently, the Co-Authorship Index (CAI) has been taken into considered for the single author (first block) as follows:

$$CAI = \{(187/561) / (1293/9307)\} * 100$$
$$CAI = 239.93$$

Likewise, the Co-Authorship Index (CAI) is measured for every block and given in Table VIII. For measuring the Co-Authorship Index (CAI), the entire contributions were divided into four blocks as per the formula and the results of Co-Authorship Index (CAI) are presented in Table VIII. It is seen from the Table VIII that the value of Co-Authorship Index (CAI) for single-author contributions was higher in the first, second and third blocks and declined in the fourth block. Likewise, for two-author's contributions, the Co-Authorship Index (CAI) in the first block, second block and third block was higher and declined in the fourth block. The Co-Authorship Index (CAI) for more than two authors' contributions was decrease in the first block, second block and third block and enriched in the fourth block period i.e. from the year 2015 to 2019. This shows that the group of researchers worked together in the field of Neuroanatomy research is an increasing trend in current years.

TABLE VIII CAI BY YEAR-WISE IN THE DISCIPLINE OF NEUROANATOMY

Sl. No.	Year	Single Author	Two Authored	More than Two Authors	No. of Records
1	1980-1989	187 (239.93)	171(179.66)	203(52.34)	561
2	1990-1999	295(147.46)	332(135.89)	813(81.66)	1440
3	2000-2009	395(109.56)	486(110.39)	1714(95.53)	2595
4	2010-2019	416(63.56)	590(73.82)	3705(113.75)	4711
Anonymous					43
Total		1293	1579	6435	9350

D. Pattern of Co-Authorship among Countries in the Discipline of Neuroanatomy

To study the pattern of co-authorship among countries, the complete contributions had been divided into single, two and more than two authors for each country and the results are given in the Table IX. The pattern of co-authorship among different countries has been examined with the aid of utilizing Collaborative Co-efficient (CC) recommended by Ajiferuke. The formula employed for measuring Collaborative Co-efficient (CC) is provided below

$$CC = 1- \left[\sum_{j=1}^{k} (1/j) Fj / N \right]$$

F_j = the number of authored publications
N = total number of research published; and
k = the greatest number of authors per paper

The Collaborative Co-efficient (CC) has been considered for the United States as follows.

CC = 1- [(420/3059) + ½ (542/3059) + 1/3 (2097/3059)]
= 0.55

According to Ajiferuke, the Collaborative Co-efficient (CC) indicated zero as single authored contributions greater, and on the other hand if the Collaborative Co-efficient (CC) is in increasing trend that results in multi authored contributions. In other phrases, larger the value of Collaborative Co-efficient (CC), more the chance of multi authored contributions in the field of Neuroanatomy. In this examine it is visible that the average Collaborative Co-efficient (CC) has been arrived at 0.55 which show high proportion of contributions were by multiple authors in the field of Neuroanatomy.

The value of Collaborative Co-efficient (CC) for Romania, New Zealand, Iran, Bangladesh, Israel, Pakistan, and Slovakia (0.67 each) on this study followed by Greece, and Turkey (0.64 each) and this is followed by Portugal (0.63). The countries in the table IX have also above the CC value of 0.50 suggests that those countries have better collaboration of research.

TABLE IX COLLABORATIVE COEFFICIENT (CC) AUTHORSHIP PATTERN IN THE DISCIPLINE OF NEUROANATOMY

Country	Single Authored Contributions	Two Authored Contributions	More Than Two Authors	Total	Collaborative Coefficient
United States	420	542	2097	3059	0.55
England	227	211	655	1093	0.50
Netherlands	111	163	571	845	0.55
Germany	98	108	387	593	0.53
Switzerland	47	36	85	168	0.44
Ireland	13	26	108	147	0.58
France	18	18	86	122	0.54
Italy	30	23	51	104	0.44
Austria	6	11	72	89	0.60
Japan	33	11	37	81	0.37
Spain	24	12	30	66	0.39
Poland	15	6	23	44	0.42
China	2	5	20	27	0.59
Russia (Federation)	8	8	10	26	0.41
Denmark	5	3	11	19	0.46
Hungary	9	4	5	18	0.30
Scotland	5	0	12	17	0.47
United Arab Emirates	2	9	5	16	0.49
Australia	4	6	5	15	0.42
Brazil	2	0	13	15	0.58
Canada	7	0	4	11	0.24
Belgium	5	0	4	9	0.30
Argentina	5	3	0	8	0.19
India	0	3	5	8	0.60
Romania	0	0	7	7	0.67
Sweden	2	3	2	7	0.40
Boca Raton (FL)	2	2	2	6	0.39
Greece	0	1	5	6	0.64

Turkey	0	1	5	6	0.64
Czech Republic	4	0	1	5	0.13
Norway	2	1	2	5	0.37
Finland	1	1	2	4	0.46
Mexico	2	1	1	4	0.29
New Zealand	0	0	4	4	0.67
Portugal	0	1	3	4	0.63
China (Republic: 1949-)	1	0	2	3	0.44
Croatia	1	0	2	3	0.44
Iran	0	0	3	3	0.67
Korea (South)	1	0	2	3	0.44
Bangladesh	0	0	2	2	0.67
Singapore	1	0	1	2	0.33
South Africa	0	2	0	2	0.50
Bosnia and Herzegovina	0	1	0	1	0.50
Bulgaria	1	0	0	1	0.00
Colombia	1	0	0	1	0.00
Israel	0	0	1	1	0.67
Kenya	0	1	0	1	0.50
Pakistan	0	0	1	1	0.67
Puerto Rico	1	0	0	1	0.00
Salt Lake City (UT)	1	0	0	1	0.00
Serbia	0	1	0	1	0.50
Slovakia	0	0	1	1	0.67
Thailand	1	0	0	1	0.00
Ukraine	0	1	0	1	0.50
Uruguay	1	0	0	1	0.00
Not Mentioned	174	354	2090	2618	0.60
Anonymous Author				43	
Total	1293	1579	6435	9350	0.55

IX. FUNDAMENTAL FINDING OF LITERATURE IN THE AREA OF NEUROANATOMY

1. A complete of 9350 of the records in the research productiveness in the subject of Neuroanatomy during the years i.e. from the year 1980 to 2019.
2. The maximum number of 638 records was published in the year 2018 in the discipline of Neuroanatomy.
3. The United States is the prime producer, followed by England, Netherlands, Germany, and Switzerland etc.
4. Indian contributions were ranked in the 20th position with 0.09% of overall output.
5. A total of 33.28% covered by means of the Research Support, Non-U.S. Gov't; followed by Journal Article (28.79%), Review (20.62%), etc.
6. 96.33% of records were in English language in the area of Neuroanatomy.
7. There is a fluctuation trend in the study of Relative Growth Rate (RGR) and Doubling time (Dt) when calculated by year-wise in the discipline of Neuroanatomy.
8. A complete of 85.71% of papers is written by multi-authors.
9. The ratio represents that the single and multi-authors' papers is 1:7 in the area of Neuroanatomy.
10. It was found that meager percent i.e. 0.46% of records represent nameless authorship.
11. The year-wise Degree of Collaboration (DC) shows the ratio in-between 0.38 to 0.94 in the area of Neuroanatomy.
12. The value of Co-Authorship Index (CAI) for single-author contributions were higher in the first, second, and third blocks and declined in the fourth block in the subject of Neuroanatomy.
13. Likewise, for two-author's contributions, the Co-Authorship Index (CAI) in the first, second, and third blocks were higher and declined in the fourth block in the field of Neuroanatomy.
14. The Co-Authorship Index (CAI) for more than two authors' contributions was lower in the first, second, and third blocks and enriched in the fourth block in the field of Neuroanatomy.

15. The average Collaborative Co-efficient (CC) has been arrived at 0.55 which indicates massive variety of contributions was by multiple authors in the discipline of Neuroanatomy.
16. The entire study exposed that the multi-authors' contributions are high in the field of Neuroanatomy.
17. It also shows that the collaboration in Neuroanatomy research is in an increasing trend in current years.

X. CONCLUSION

It is determined that MEDLINE database covered with a complete of 9350 records in the subject of Neuroanatomy. Result exposes that Neuroanatomy literature is growing year after year but it is in a fluctuation trend. The United States is the most important producer, followed by England, Netherlands, Germany, and Switzerland etc. The average degree of collaboration has been arrived at 0.86. Multi authored papers are more than single authored papers which suggests that collaborative of research is higher in the field of Neuroanatomy in the study period. English language papers ruled in the subject of Neuroanatomy.

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