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Research Article

Exploring Collaboration Pattern and Bibliographic Coupling of Anatomy Research

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Abstract

Objectives: This collaboration model study aimed to conduct a multi-dimensional collaboration of top 200 most cited articles in the anatomical research area to create easy access for researchers in this dynamic field.

Methods: The word 'anatomy' used as a search term has been written and searched in Thomson Reuter's Science Database on 21.02.2021 to list all relevant articles in this field, we choose the top 200 most cited articles for analysis. Citation Collaboration, Bibliographic Coupling Sources, Organization Collaboration, Country Collaboration, Author Collaboration, have analyzed the top 200 articles cited. VOSviewer version 1.6.11 was used to visualize collaborative analysis.

Results: Eligible 1,63,426 papers were identified, and we had selected bibliometric criteria for the top 200 cited articles in the field of anatomy. The most cited article on anatomy was "The brain's default network: Anatomy, function and relevance to disease" (5746 citations) conducted by Buckner RL., *et al*. and the least number of the most cited article entitled "Functional-anatomy of the mental representation of upper extremity movements in healthy-subjects" (698 Citations) conducted by Stephan KM., *et al*. Neuroimage journal is the highest citation contribution among the top 200 sources. Harvard University, USA is the most prolific institutions in the total analysis with n = 17. The United States of America took first place with 121 appearances, followed by England (n = 31).

Conclusion: This study shows that, without time limitation, anatomical research has steadily become more comprehensive at the global level. Although anatomical studies are increasingly needed to improve towards neuroanatomy, neuroscience studies and other related medical specialties.

Keywords: *Anatomy; Bibliometric Analysis; Collaboration Pattern*

Introduction

Anatomy is a scientific study of living things their structure of organs, including their systems, and tissues [1]. It includes the detailed study of the different parts, the materials from which they are made, their location, and their relationship to other parts [2]. Anatomy has remained the most important and essential part of medical science throughout history. Discoveries in molecular cells and developmental biology and, most recently, the emergence of human-induced pluripotent stem cells and organoids have been increasingly inspired by

anatomy as a descriptive subject of medical study and instruction [3]. One of the oldest branches of medicine that have helped medical knowledge to evolve is human anatomy [4]. Human anatomy may also be regarded, from a historical point of view, as one of the fundamental foundations of medical education [5].

Human anatomy is one of the fundamental sciences in medicine [6]. The anatomy discipline is split into macroscopic and microscopic. The inspection of the body parts of an animal using unaided eyesight is macroscopic anatomy or gross anatomy. The branch of superficial anatomy contains gross anatomy as well. The use of optical instruments to research the tissues of different structures called histology as well as the study of cells includes microscopic anatomy [7]. In this article we attempt to show case the top 200 highly cited articles collaboration and research pattern.

Materials and Methods

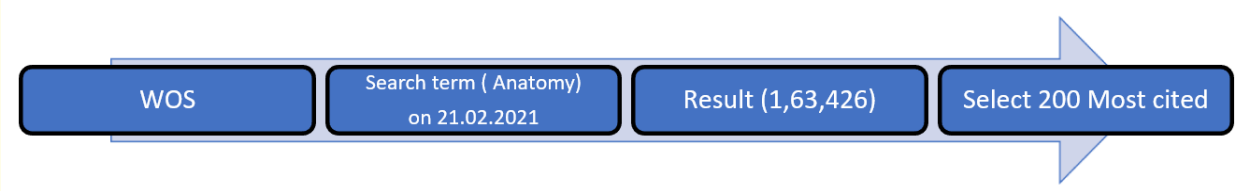
Database

A decision to use the required database for the recovery of the related documents is the initial phase of any bibliometric analysis. In the current research, the Clarivate analysis web of science was used to accomplish the objective of the study. The comprehensive science web platform allows ideas to be tracked through disciplines and time from over 1.9 billion references cited from over 171 million documents [8].

Data retrieval

Raw data was extracted from the Clarivate analysis web of science. The word 'anatomy' is used as a search term on 21.02.2021. Excel and Text format types of data are collected from the web of science. Table created from excel and some of collaborations analysis tables is created from VOSviewer version 1.6.11 visualization software.

Results



Figure

A total of 1,63,426 original research articles are shown in the results. We retrieved a total of 200 most cited articles that met our criteria. Table 1 categorizes based on highest citations from 1939 to 2015 without continuity. A total of 200 articles are found with 250418 citations. out of a total of 36 years, 1998 was the highest citation with 27208 and 21 articles. The number of publications increased from 1995 to 2008 with an average of 10.5 articles per year, again decreased. The total number of 200 most cited articles are displayed in the figure format (Figure 1 and 2).

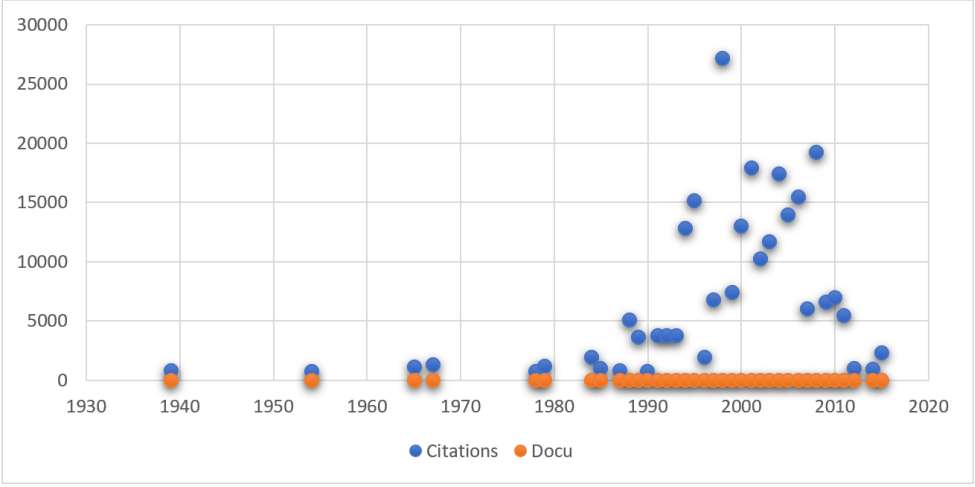


Figure 1: *Citation collaboration pattern.*

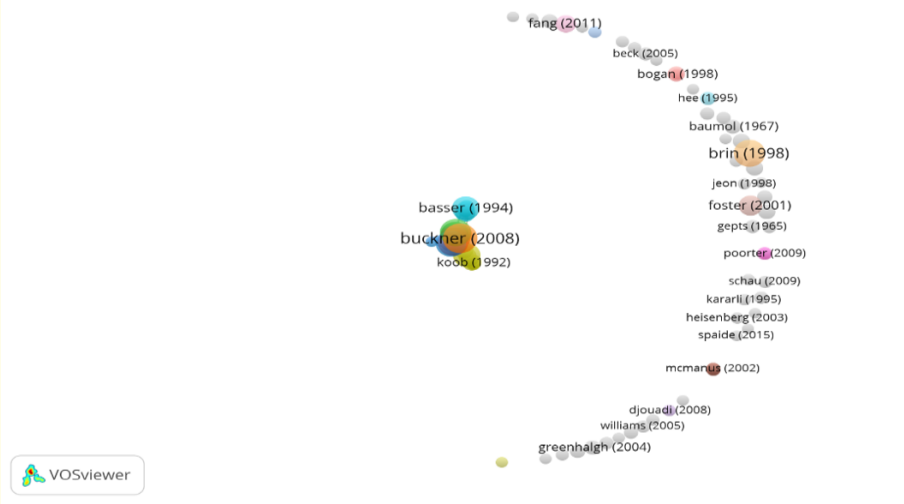


Figure 2

The number of papers with average citation numbers for each paper in descending order for Journals in the 200-highest cited articles (Table 2). *Neuroimage* (18), *Brian Journal, Journal of Neuroscience*, and *Nature Journal* each (8) and the lowest numbers contain the *Journal of Neurophysiology* journals (4) were listed in the top 10 journals. *Trends in Neurosciences journal* got the second-highest citations with (9759).

Sl. No	Label	Doc	Citations	Norm. citations	Avg. pub. year	Avg. citations
1	*Neuroimage*	18	25012	20.525	2004.78	1389.56
2	*Brain*	8	9446	8.0393	2000.5	1180.75
3	*Journal of Neuroscience*	8	7432	6.7531	1997	929.00
4	*Nature*	8	9181	7.8498	1995.75	1147.63
5	*Proceedings of the National Academy of Sciences of the United States of America*	7	9084	7.4198	1998.57	1297.71
6	*Science*	7	7872	5.9764	1995.86	1124.57
7	*Trends in Neurosciences*	6	9759	5.712	1995.67	1626.50
8	*Cerebral Cortex*	5	4714	3.688	2002.4	942.80
9	*Human Brain Mapping*	4	5381	5.0662	1997.5	1345.25
10	*Journal of Neurophysiology*	4	5573	4.259	2006.25	1393.25

Table 2: *Top 10 bibliographic coupling sources.*

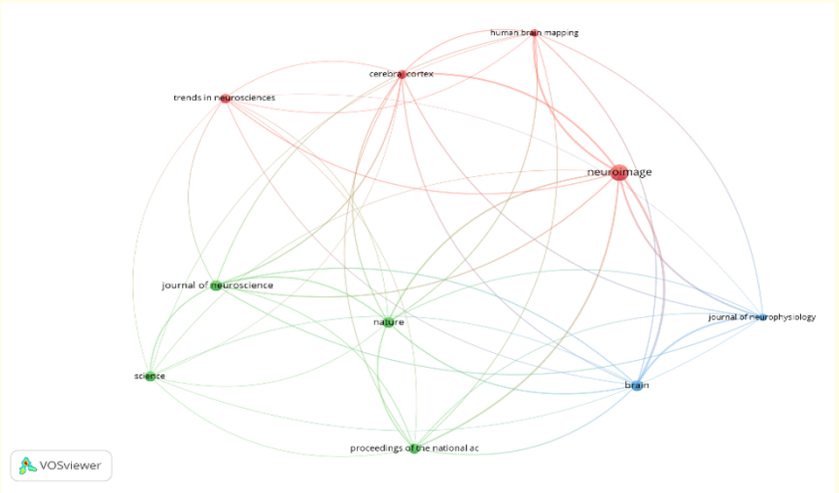


Figure 3

Sl. No	Organization	Doc	Citations	Norm. citations	Avg. pub. Year	Avg. citations
1	Harvard University, USA	17	27834	21.86	2003.88	1637.29
2	Boston University Center for Biomedical Imaging, USA	12	20538	16.50	1999.33	1711.50
3	McConnell Brain Imaging Centre - McGill University, Canada	9	12167	9.71	2000.11	1351.89
4	UCL, Wellcome Dept Cognit Neurol, London WC1N 3BG, England	8	10628	9.32	1999.00	1328.50
5	MIT, Dept Biol, Whitehead Inst Biomed Res, Cambridge, MA 02142 USA	8	9453	7.86	2003.88	1181.63
6	University of Pittsburgh, USA	8	11720	9.22	2003.75	1465.00
7	Washington University, USA	8	12004	9.54	2001.38	1500.50
8	Johns Hopkins University, USA	7	6855	5.76	2003.57	979.29
9	Inst Neurol, Wellcome Trust Ctr Neuroimaging, London WC1N 3BG, England	6	6766	5.61	2003.00	1127.67
10	Stanford University, USA	6	10490	8.73	2004.00	1748.33

Table 3: *Top 10 organizations collaboration.*

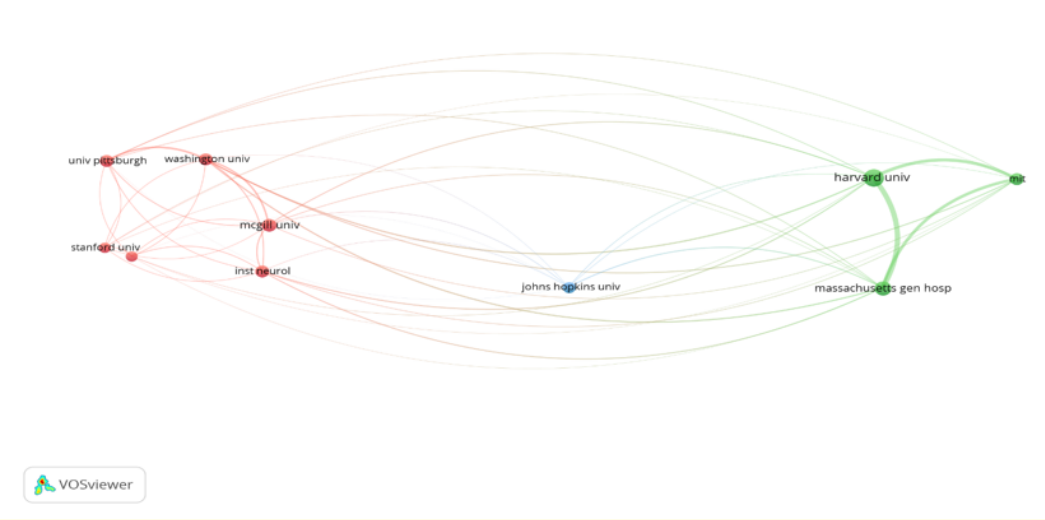


Figure 4

The institution with the largest number of papers was led by the Harvard University, USA (17) followed by the Boston University Center for Biomedical Imaging, USA (12). Four institutions produced eight articles: UCL, Wellcome Dept Cognit Neurol, London WC1N 3BG, England, MIT, Dept Biol, Whitehead Inst Biomed Res, Cambridge, MA 02142 USA, University of Pittsburgh, USA, Washington University, USA. The remaining 4 different institutions produced two articles, respectively. Out of ten institutions, seven institutions are in the USA. The table above is made up of a total of 10 organizations of which 7 organizations are in the united states, three organizations are in the UK, and one organization in Canada.

Sl. No	Country	Doc	Citations	Norm. citations	Avg. pub. Year	Avg. citations
1	USA	121	149810	121.90	2000.62	1238.10
2	England	31	37398	31.86	2001.45	1206.39
3	Germany	15	15082	12.83	2002.87	1005.47
4	France	13	12686	10.11	2002.92	975.85
5	Canada	10	13038	10.40	1999.90	1303.80
6	Italy	8	14361	11.74	1998.63	1795.13
7	Netherlands	8	7726	6.41	2003.63	965.75
8	Switzerland	8	10038	8.55	2001.75	1254.75
9	Australia	3	2886	2.52	2006.67	962.00
10	Spain	2	2347	1.97	2007.00	1173.50

Table 4: *Top 10 country collaboration.*

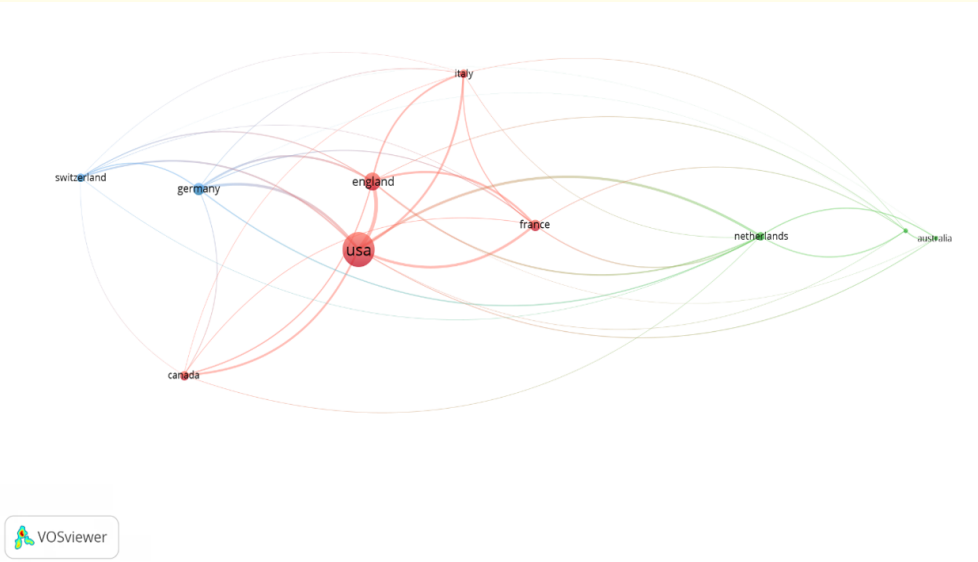


Figure 5

In table 4, respectively, the origin countries for the T200 papers are mentioned. These 200 papers have been submitted concerning the countries of origin, in total, 21 different countries. However, the top ten countries are listed. More than half of the papers in the USA (121), the UK (31), Germany (15), France (13), and other countries are the most prolific nation to come.

Sl. No	label		Doc	Citations	Norm. citations	Avg. pub. Year	Avg. citations
1	Friston, KJ	University College London, Inst Neurol, LONDON, ENGLAND	7	11662	10.08	1998.57	1666.00
2	Frackowiak, RSJ	Institute of Neurology, University College London, London, WC1N 3BG, UK	6	7299	6.81	1994.00	1216.50
3	Buckner, Randy L.	Harvard University, Dept Psychol, CAMBRIDGE, MA, USA	5	12245	9.40	2009.20	2449.00
4	Evans, AC	McGill University, Montreal Neurol Inst, MONTREAL, PQ, CANADA	5	8493	6.69	1996.60	1698.60
5	Frith, CD	University of London, Sch Adv Study, LONDON, ENGLAND	5	6519	5.93	1995.60	1303.80
6	Passing-ham, RE	University of Oxford, Dept Expt Psychol, OXFORD, ENGLAND	4	3500	2.94	1997.25	875.00
7	Petersen, SE	Washington University (WUSTL), Dept Psychol & Brain Sci, ST LOUIS, MO, USA	4	5484	4.25	1992.75	1371.00
8	Brooks, DJ	Aarhus University, Dept Nucl Med, AARHUS, DEN-MARK	3	2512	2.32	1993.33	837.33
9	Holmes, CJ	University of Georgia, Ctr Family Res, ATHENS, GA, USA	3	2813	2.38	1997.00	937.67
10	Raichle, ME	Washington University (WUSTL), St Louis Sch Med, ST LOUIS, MO, USA	3	4206	2.87	1993.33	1402.00

Table 5: *Top 10 author collaboration.*

In the T200 most cited articles, a total of 872 authors researched Anatomy. Among the top ten authors who participated in anatomical studies (Table 5), Friston, KJ, University College, London, Inst Neurol, LONDON, ENGLAND with 7 publications, Frackowiak, RSJ (6 publications), Buckner, Randy L., Evans, AC, Frith each, each CD was regarded as highest in rank (5 Publications). Of a total of 10 authors, four are published in the UK and the U.S., and one in Denmark and Canada.

Limitations of the Study

This study is the first top 200 citation collaboration pattern bibliometric analysis among the anatomy study carried out. The analysis of data was done from the web of science physically, we selected the top 200 most cited articles from the total result of 1,63,426. We are selected the data based on the most cited included all types of articles.

Conclusion

Anatomy is a description of structures and on the other side physiology is a study of the working of these structures [9]. Anatomical terms are particularly important in the field of the theme since they prevent confusion with the structures and help to pinpoint the position and provide more precision [10]. The bibliometric study is provided a vital role in the field of anatomy research [11]. While research-based on anatomy has gradually developed towards Anatomical morphology, neuroanatomy, and neuroscience. Nonetheless, emerging technology-based Studies have shown that there is a need for further research in Studies in neuroscience and neuroimaging, which do not classify the forces which influence the neuroanatomical direction Studies. The research has been conducted from 1939 to 2015 especially since after 2015 number of research articles have been declining, no research has been included after 2015. The author and countries in Anatomical research are dominant from European countries in this analysis, there were very few other countries were included in this analysis, which means the rest of the counties need to focus more on anatomy research. It was an interesting finding that total of 200 articles (top cited articles) are found with 250418 citations with the inclusion of 36-year time frame, which is considered the be highly referred studies were produced by the Anatomy study researchers.

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