



Analysis of Retracted Articles in the Field of Immunology: A Scientometric Study

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Abstract

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Introduction: The volume of Retracted articles in all fields have increased significantly in recent years. Retracted publications in medical field may endanger the health of patients and also cause disturbances in the decisions of specialists. Immunology is one of the most important branches of medicine, so this study is conducted to investigate the reasons for retraction and analyze retracted articles of immunology.

Methods: This scientometric study was done in 2023 on the retracted articles of immunology. The data were obtained from the Web of Science database and were analyzed by R4.2.2, Biblioshiny software, Also, the Retraction Watch database has been used to identify the reasons for retractions.

Results: The findings showed that the retracted articles of immunology have been increased significantly in recent years. From the 240 retracted publications of immunology available in the WoS database. The largest number of retracted articles were published by “Journal of Immunology” and “UNIV TEXAS” among institutions. The USA contributed the most in producing such articles. The most keywords of retracted articles were expression and activation. 72 immunology journals have published retracted papers on Web of Science, most of these articles were in quartile 2 journals. The main reason for retracting articles was “Investigation by Company/Institution”.

Conclusion: Reviewing the reasons for retracting articles gives important information to editors and editorial boards of journals, authors and experts to avoid similar cases. Research ethics guidelines help researchers in producing and publishing authentic articles, so it's recommended that authors be aware of the contents of ethical guidelines.

Introduction

The strong desire of authors to publish their articles in prestigious journals, as well as the interest of journals in publishing more articles, has

led to a rapid increase in the number of articles and, as a result, an unprecedented rate of publication in recent years (1-3). Also, the increasing rate



of publishing articles has caused articles to be retracted for many reasons, such as plagiarism, data falsification, scientific violations, duplication of image, editorial mistakes, error in methods, fabrication, data analysis errors, unreliable results, etc. (4,5). Retraction is the removal of a published academic paper from a journal, which can be initiated by the editors or authors of the papers (6). Retractions are often accompanied by a notice explaining the reason for the retraction, which may also include an apology and expressions of gratitude to individuals who brought the error to the author's attention (7). The impact of retracted articles on the scientific community and future research must be highlighted, considering the primary reasons why journal editors and editorial boards retract articles (8).

A review of various medical science journals, databases and scientific paper shows that the amount of retracted publications has increased significantly in recent years, especially in biomedical sciences (9-11). Immunology is one of the branches of medicine (12). Immunology is a field that intersects with various other disciplines such as molecular and cellular biology, genetics, and biochemistry (13). Immunology studies are directly related to people's health due to their physiological role in the immune system and immune responses such as autoimmune diseases, allergic hypersensitivity, immune disorders, immunodeficiency, and especially transplant rejection, as well as its impact on the treatment of patients is too important (14). The growing number of retracted articles raises concerns about scientific misconduct and its impact on the foundations of future studies and public health (15). One of the primary consequences of retracted papers is the continued citation of these publications even after retraction, which is alarming for the scientific community, as most retracted publications continue to receive positive citations regardless of whether they were retracted due to misconduct (16-19). Therefore, it is very important to recognize the reasons for retraction, and it is necessary to analyze the retracted articles in the field of immunology. No research was retrieved that examines the retracted

articles of immunology, so this article analyzes these articles and identifies the reasons for the retracted publications of immunology.

Methods

In this study, we used scientometric techniques to analyze the scientific status of retracted articles of immunology in the Web of Science (WoS) database. The items investigated in this research include articles, journals, authors, institutions and universities, countries, and keyword plus of the retracted articles.

The WoS Core Collection was used to collecting data. For a comprehensive search, we utilized the WoS Categories feature to access all articles related to immunology (WC=immunology). All the languages were selected and in the next step, to focus on retracted articles related to immunology, the search was limited to "retracted publication" document type. The number of retrieved articles was 240 on May 2, 2023. During data extraction, the "Full Record and Cited References" option was selected for all of the retracted articles and finally, it was saved in a "plain text" file.

The collected data were transferred to R 4.2.2 software and Bibliometrix Package (Biblioshiny) for scientometric analysis. The software shows the results by tables and figures. Using this software, it is possible to access information about retracted articles, such as journals that publish these articles, countries, authors, institutions, and universities, citations, and trends of keywords.

The Retraction Watch database (retraction database.org) was used to identify the reasons for retraction of immunology articles. The retracted articles were retrieved by, using the Digital Object Identifier (DOI) in the Retraction Watch database in the original paper section. For articles without a DOI, the article title was used. Out of 240 retracted articles, 14 articles were not indexed in this database, so the Retraction Watch database does not report the reasons for retraction of these articles.

Results

Scientific production

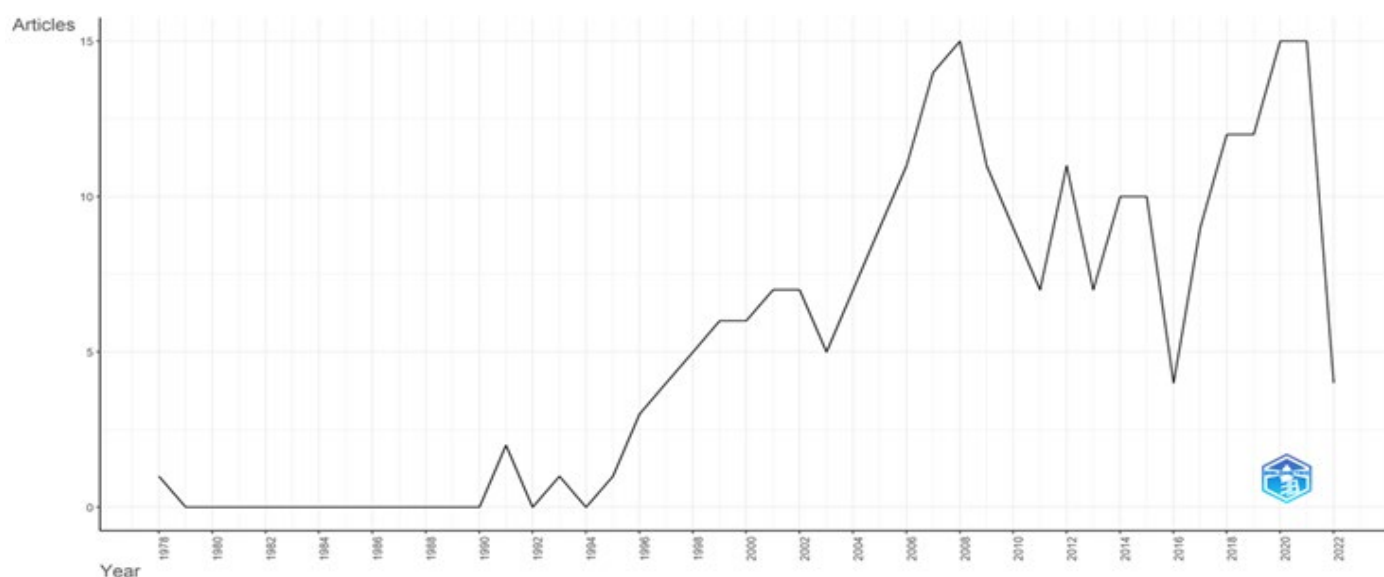


Figure 1. Annual scientific productions of retracted articles in the field of immunology from 1978-2022

By searching the WoS database, 240 retracted articles of immunology were retrieved that were indexed in 72 journals. Figure 1 reveals that the primary retracted article in immunology can be traced back to 1978 and continued with four articles until 2022. The number of retracted articles of immunology was high in 2008, 2020, and 2021 (N=15). Also, from 1979 to 1990, 1992, and 1994 no retracted articles

were recorded on the WoS database. The number of retracted articles in 2000-2022 (N=217) compared to 1978-1999 (N=23) has increased almost tenfold.

Table 1 shows the number and type of retracted articles of immunology. The most types of the retracted documents were articles (N=213), proceeding papers (N=9), and review articles (N=7), respectively.

Table 1. Type of document-retracted articles in the field of immunology

Type of document	Number of documents
Article	213
Proceedings paper	9
Review	7
Letter	4
Correction	3
Meeting abstract	2
Note	1
Editorial material	1

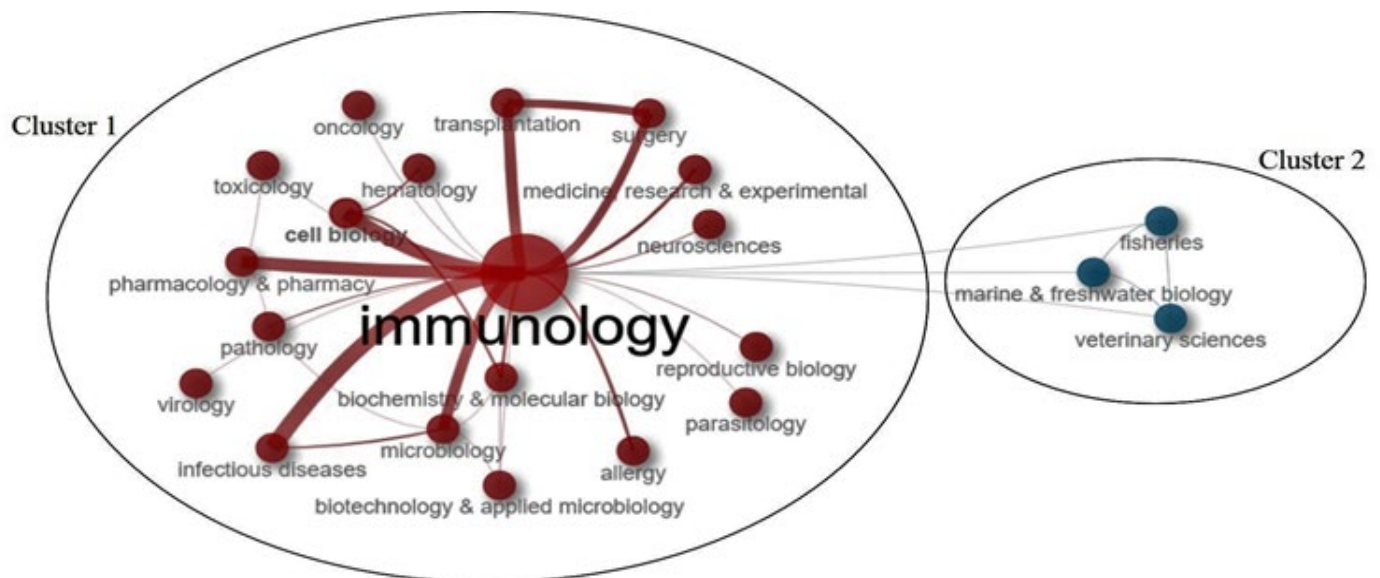


Figure 2. The relationship between the category of immunology and other categories in the production of retracted articles from 1978-2022

Figure 2 displays the relationship between WoS categories of retracted articles published in the field of immunology with other categories. The graph exhibits two clusters. So, the connection of immunology with infectious diseases, pharmacology & pharmacy, and cell biology have been closer.

Analysis of journals

Table 2. Journals with the highest number of retracted articles in immunology from 1978-2022

Journal	N. of documents	Total citations to retracted articles	Two year-impact factor (2022)	Category quartile	Category rank of 161
Journal of immunology	34	1554	4.4	Q2	77
International immunopharmacology	19	562	5.6	Q2	56
Infection and immunity	15	492	3.1	Q3	118
Transplantation	14	846	6.2	Q2	45
Immunity	8	945	32.4	Q1	2
Journal of inflammation research	8	78	4.5	Q2	76
Cytokine	6	83	3.8	Q3	94
Journal of experimental medicine	6	219	15.3	Q1	9
Microbial pathogenesis	6	66	3.8	Q3	94
Clinical and experimental immunology	5	139	4.6	Q2	74
Fish and shellfish immunology	5	18	4.7	Q2	73
Inflammation	5	26	5.1	Q2	65
Journal of allergy and clinical immunology	5	374	14.2	Q1	11
Journal of reproductive immunology	5	31	3.4	Q3	105
Transplantation proceedings	5	49	0.9	Q4	157
Journal of neuroinflammation	4	147	9.3	Q1	21
Vaccine	4	70	5.5	Q2	57

Table 2 shows the list of journals that have published the most retracted articles in the field of immunology. 72 journals have published retracted articles, and the highest number of retracted articles in immunology was published by Journal of immunology (IF=4.4), International immunopharmacology (IF=5.6), Infection and immunity (IF=3.1), Transplantation (IF=6.2) with 34, 19, 15, and 14, and these journals

have 1554, 562, 492 and 846 citations for retracted immunology articles in the WoS database, respectively. The results show that the journal with the name Immunity (IF=32.4) has eight retracted articles, and the articles of this journal have received a total of 945 citations, which ranks second among the most cited journals after Journal of immunology.

Analysis of author

Table 3. Authors responsible for most retracted articles in immunology from 1978-2022

Authors	N. of documents	Total citation of retracted article	H-index of retracted article	PY-start retracted article
Thomas JM	8	332	6	1998
Pease LR	7	328	7	2002
Radhakrishnan S	7	328	7	2002
Bulfone-paus S	6	233	6	2000
Matsuyama W	6	144	5	2003
Mori N	6	154	6	1999
Thomas FT	6	302	5	1998
Yamamoto N	6	201	6	1999
Arimura K	5	100	5	2005
Budagian V	5	226	5	2001
Bulanova E	5	226	5	2001
Higashimoto I	5	100	5	2005
Neville DM	5	297	5	1998
Osame M	5	100	5	2005
Shah FA	5	61	3	2020

Table 3 gives different information, including the number of retracted articles, the number of citations to retracted articles, H-Index, and the publication year (PY) starting the retraction article of each author.

Thomas JM, Pease LR, Radhakrishnan S, Bulfone-paus S, Matsuyama W, Mori N, Thomas FT, and Yamamoto N are the authors who had the most retracted article in immunology.

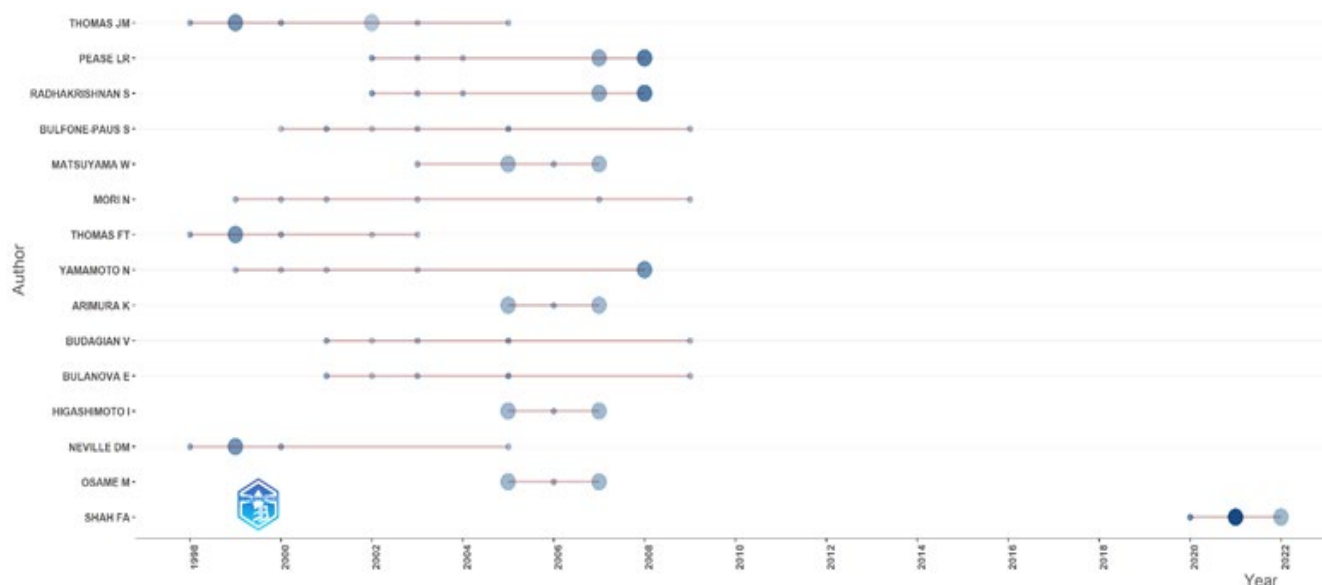


Figure 3. Authors with the most retracted articles in immunology from 1978 to 2022

Figure 3 offers the Timeline of the top 15 researchers who have the most retracted articles. The red line indicates the beginning and quit years of the retracted articles for a researcher, and the scale of the dot shown within the parent implies the range of retracted articles

published by researchers in that unique period. Mori N had the longest timeline in producing retracted immunology articles from 1999 to 2009. Also, in recent years, Shah FA has played an important role in producing retracted articles.

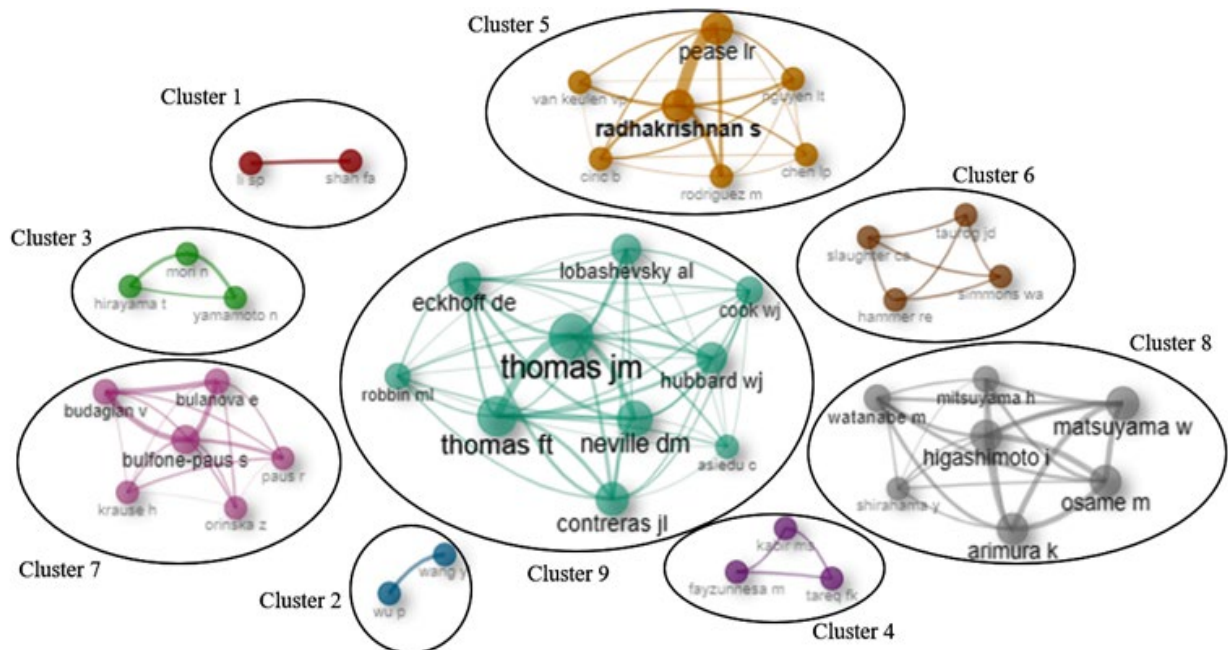


Figure 4. Collaboration network of authors with retracted articles in immunology from 1978-2022

Figure 4 displays the collaboration network of authors who contributed to published retracted articles in immunology. This network consists of 9 clusters. Three clusters with the most retracted articles are discussed. Cluster 9, consists of 10 researchers and 44 retracted articles, in this cluster Thomas JM, Thomas FT, and Neviile DM are the main researchers. Clusters 8 and 5 are the second and third clusters by the number of authors. Cluster 8 is composed of seven

authors with 32 retracted articles, where Matsuyama W, Arimuara K, Higashimoto I, and Osame M have a major role in publishing retracted articles. Additionally, cluster 5 includes seven authors and 30 retracted articles. In this cluster, the most significant role in the production of retracted articles is related to Radhakrishnan S and Pease IR. As you can see in the fig 4, there is no connection between clusters.

Analysis of institutions

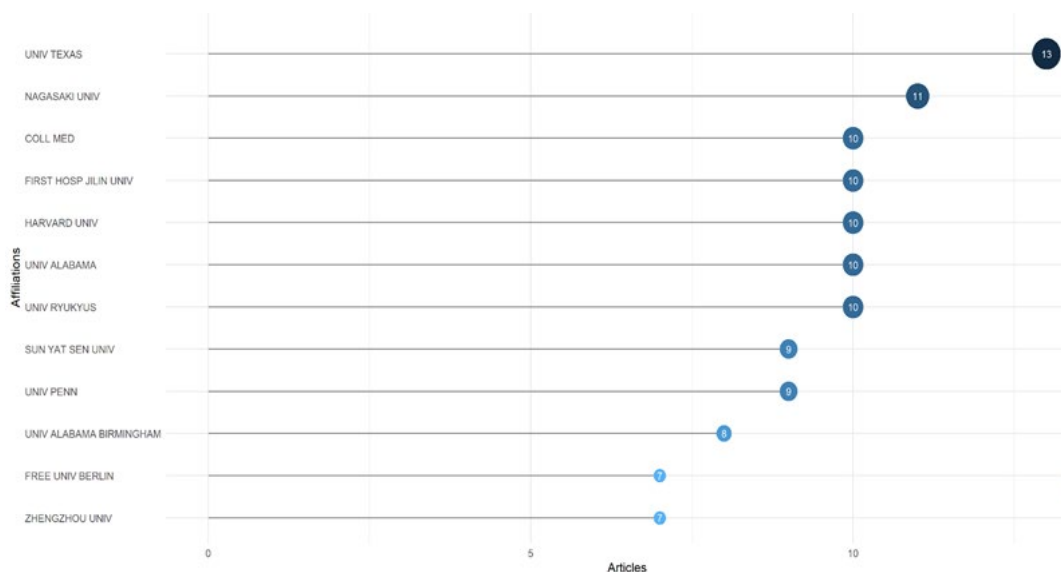


Figure 5. Collaboration network of authors with retracted articles in immunology from 1978-2022

Figure 5 displays the top institutions and universities that have the most retracted article. Univ Texas and Nagasaki Univ are ranked first and second with 13 and 11 retracted publications, respectively. Followed

by Coll Med, First Hosp Jilin Univ, Harvard Univ, Univ Alabama, and Univ Ryukyus with 10 retracted publications.

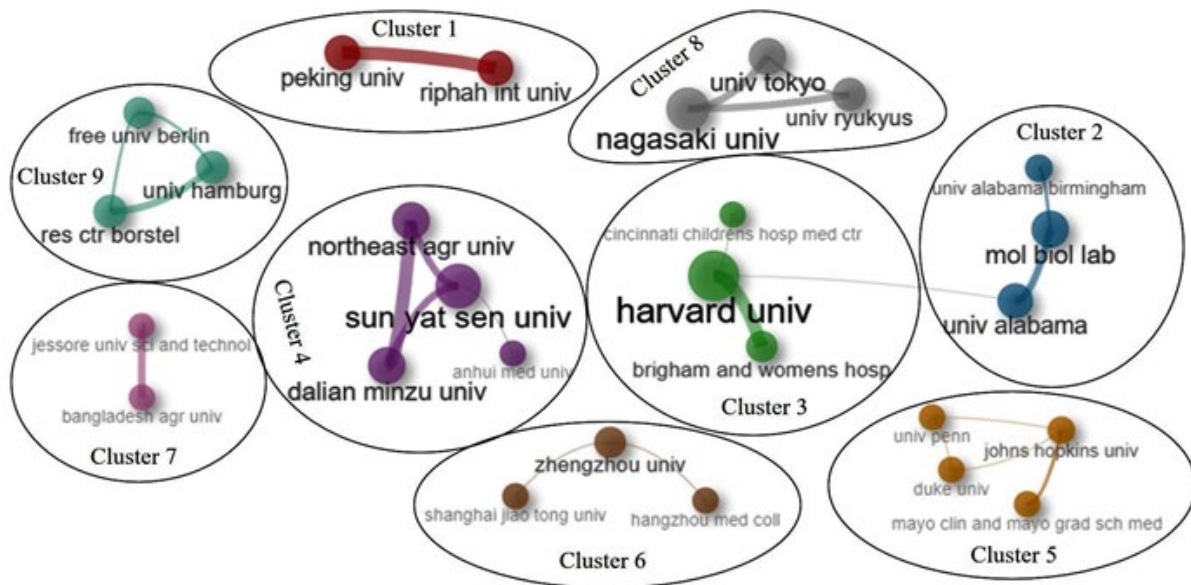


Figure 6. Collaboration network of institutions and universities that published retracted articles in immunology from 1978-2022

Figure 6 illustrates the collaboration network of institutes that have published retracted articles in immunology. The fig displays 9 clusters, with clusters 4 and 5 being the largest and each one consisting of 4 institutes. Cluster 4 consists of Sun Yat Sen Univ, Dalian Minzu Univ, Northeast Agr Univ, and Anhui

Med Univ. Cluster 5 consists of Univ Penn, Duke Univ, Mayo Clin and Mayo Grad Sch Med, and Johns Hopkins Univ. Also, Harvard Univ from Cluster 3 with Univ Alabama from Cluster 2 cooperated to publish the retracted article.

Analysis of country

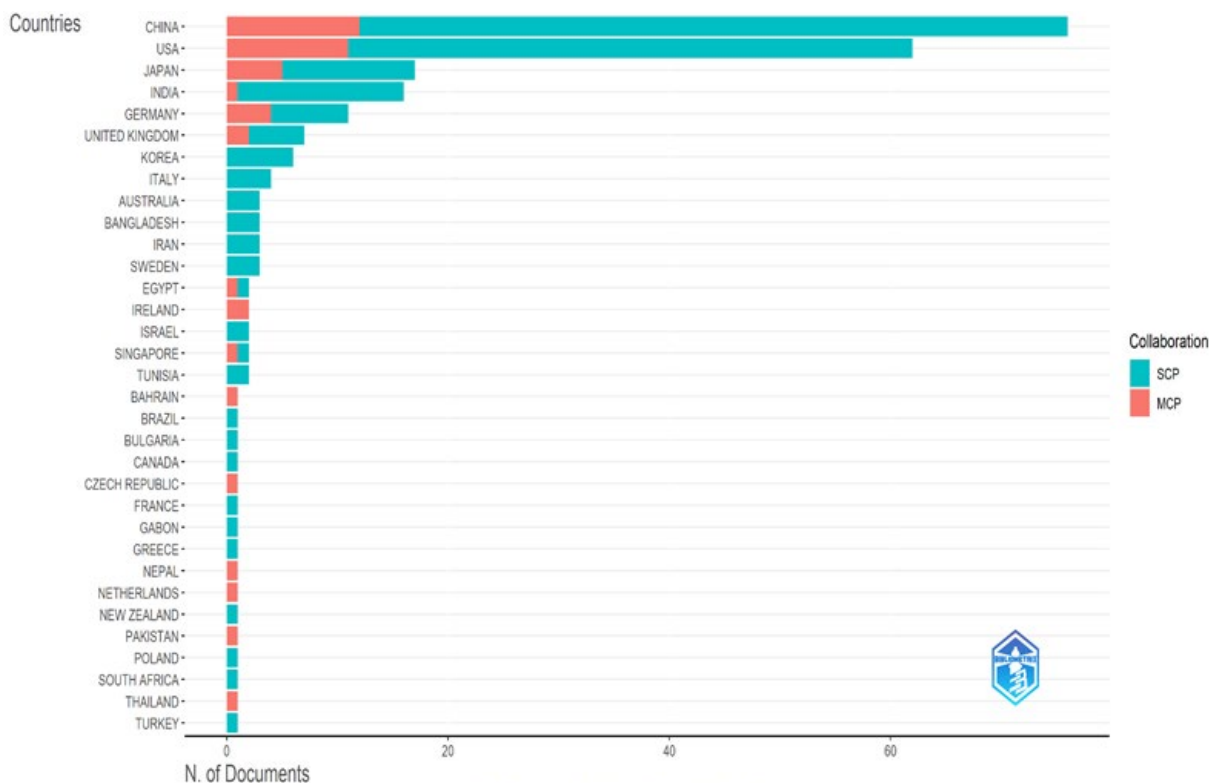


Figure 7. Countries of corresponding authors of retracted immunology articles from 1978 to 2022



Figure 7 shows the distributions of retracted articles for each corresponding author's country based on two indicators, multiple countries publications (MCP) and single country publications (SCP). out of 240 retracted immunology articles, three did not have information about the corresponding author's countries. As a result, these three articles were not studied in the analysis of this section. Globally 33 countries participated in producing 237 retracted articles in immunology. The countries that contributed the most to the publication of retracted articles in immunology are China, USA,

Japan, and India. China has published 64 out of 76, as a SCP, while the remaining 12 articles were published as MCP. Out of 62 retracted articles from USA, 51 and 11 articles have been published in single and multiple country publications, respectively. Korea, Italy, Australia, Bangladesh, Iran, Sweden, Israel, Tunisia, Brazil, Bulgaria, Canada, France, Gabon, Greece, New Zealand, Poland, South Africa, and Turkey published retracted articles only in SCP. Also, Ireland, Bahrain, Czech Republic, Nepal, Netherlands, Pakistan, and Thailand published retracted articles only in MCP.

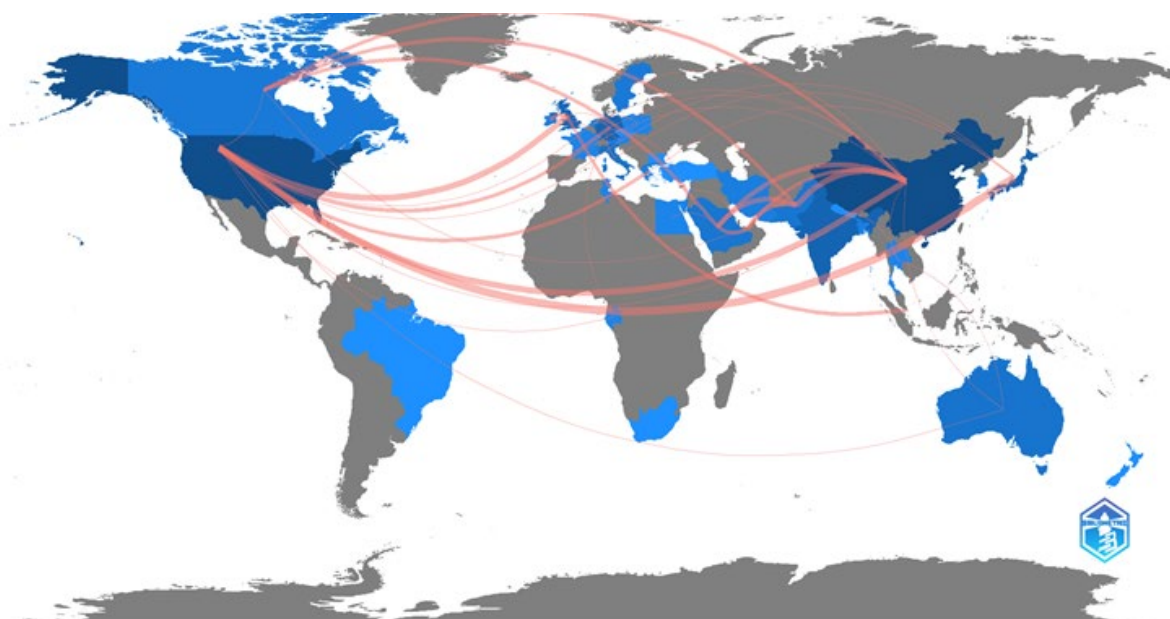


Figure 8. The country collaboration regarding retracted articles in immunology from 1978-2022

Figure 8 highlighted a network of countries that have published retracted articles in immunology, with pink lines indicating the relationships between countries. The countries with the highest number of retraction articles are represented by dark blue color while those with the lowest number are represented by light blue. Countries without any retracted articles are shown in gray. The thickness of the pink lines corresponds to the

number of retracted articles that the countries have jointly published, ranging from one to six articles. The thickest line on the graph represents collaborations between US-Japan, US-United Kingdom, US-China, and China-Pakistan, with 6, 4, 4, and 4 retracted articles, respectively. It can be argued that USA has a major role in collaboration with other countries to publish retracted articles in immunology.

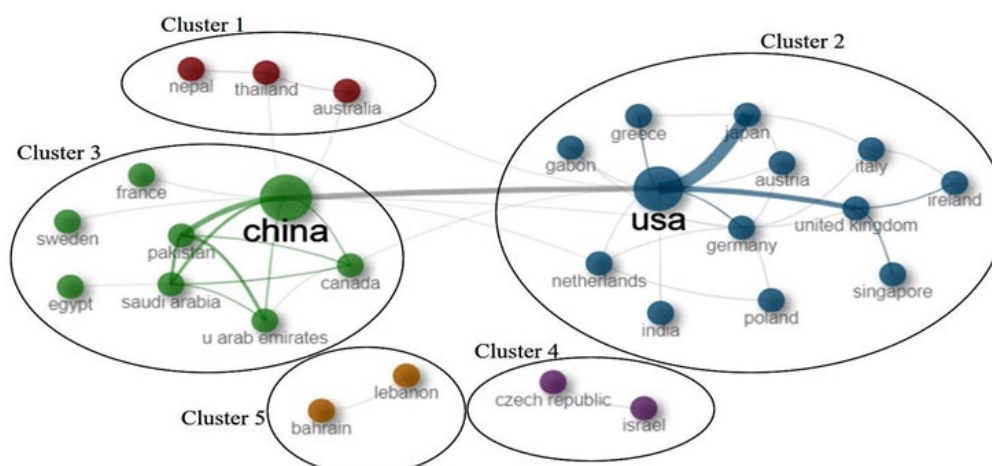


Figure 9. Collaboration network of countries who had published retracted immunology articles from 1978-2022

Due to Figure 9, the collaboration network of countries that published retracted articles in immunology has shown. There are 5 clusters in this fig, cluster 2 is the largest cluster in this network and has 13 countries, where USA has a main role in

this cluster. Cluster 3 is the second-largest cluster and consists of eight countries. In this cluster, China has an important role. Clusters 1, 2, and 3 have the connection together.

Analysis of keyword plus



Figure 10. The word cloud map of keyword plus in immunology retracted articles from 1978-2022

The word cloud in Figure 10 displays the most commonly used words in retracted immunology articles. The analysis reveals that the majority of

retracted articles focus on topics such as expression, activation, inflammation, nf-kappa-b, t-cells, in vivo, cells, dendritic cells, and induction.

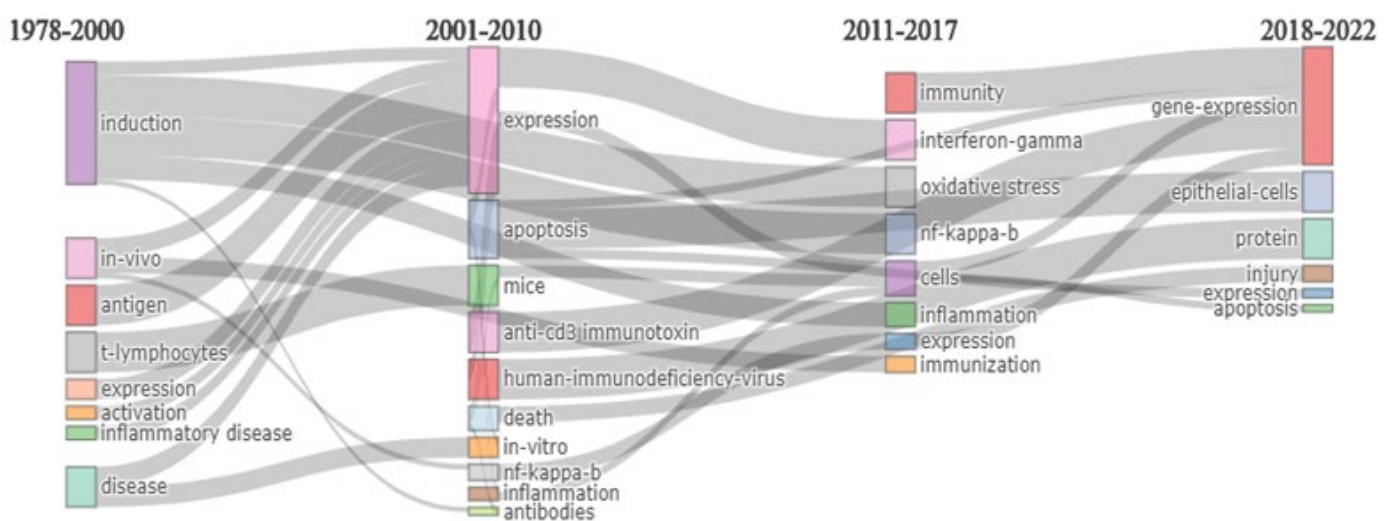


Figure 11. The thematic evolution map of keyword plus in immunology retracted articles from 1978 to 2022

Figure 11 depicts the changes in keywords over time. This fig demonstrates that the retracted article from 1978-2000 focused on induction, t-lymphocytes, antigen, in-vivo, and disease. Retracted articles from

2001-2010 were primarily concerned with expression and apoptosis in the field, as well as topics like mice, anti-cd3 immunotoxin, and human-immunodeficiency virus. Retracted articles from 2011-2017 emphasize



topics like immunity, interferon-gamma, oxidative stress, nf-kappa-b, and cells. Additionally, retracted articles in recent years (2018-2022) have concentrated

more on topics like gene-expression, epithelial-cells, and protein.

Analysis of document

Table 4. Most global cited documents in retracted immunology articles from 1978- 2022

Details of retracted articles	Doi	Total citations
Zheng SS, 2008, Transplantation	10.1097/TP.0b013e31816b67e4	371
Van Parijs L, 1999, Immunity-a	10.1016/S1074-7613(00)80103-X	368
Tripathi P, 2007, Fems Immunol Med Mic	10.1111/j.1574-695X.2007.00329.x	309
Taylor DD, 2006, J Immunol	10.4049/jimmunol.176.3.1534	231
Kelleher M, 2015, J Allergy Clin Immun	10.1016/j.jaci.2014.12.013	191
Van Parijs L, 1998, immunity	10.1016/S1074-7613(00)80478-1	167
Chaturvedi V, 2011, J Immunol	10.4049/jimmunol.1100315	160
Van Parijs L, 1999, Immunity	10.1016/S1074-7613(00)80150-8	138
Kelleher MM, 2016, J Allergy Clin Immun	10.1016/j.jaci.2015.12.1312	134
Chen Y, 2018, Int Immunopharmacol	10.1016/j.intimp.2018.03.023	130

Table 4 shows the top 10 retracted immunology articles with the most global citations in the WoS database. Articles by “Zheng SS, 2008, Transplantation”, “Van Parijs L, 1999, Immunity-a” and “Tripathi P,

2007, FemS Immunol Med Mic” have received the most citations in the WoS database with 371, 368 and 309 respectively.

Table 5. Reasons for retracting immunology articles

Reasons of retraction	Number of reasons	Reasons of retraction	Number of reasons
Investigation by company/institution	59	Objections by author	7
Duplication of image	49	Unreliable image	7
Misconduct by author	41	Concerns/issues about authorship	5
Unreliable results	31	Publishing ban	5
Falsification/fabrication of data	30	Objections by third party	5
Misconduct - official investigation/finding	30	Lack of approval from author	4
Concerns/issues about data	28	Notice - limited or no information	4
Error in data	19	Error in materials	3
Error in image	18	Notice - lack of	3
Manipulation of images	18	Breach of policy by author	2
Concerns/issues about image	17	Cites retracted work	2
Investigation by journal/publisher	17	Doing the right thing	2
Investigation by third party	17	Duplication of text	2
Results not reproducible	17	Euphemisms for duplication	2
Falsification/fabrication of image	16	False affiliation	2
Original data not provided	16	Contamination of material	2
Duplication of article	15	Notice - unable to access via current resources	2
Unreliable data	13	Plagiarism of image	2
Paper mill	12	Contamination of reagents	2
Error in results and/or conclusions	11	Concerns/issues about thirdparty involvement	1



Table 5. Reasons for retracting... (continued)

Reasons of retraction	Number of reasons	Reasons of retraction	Number of reasons
Plagiarism of article	11	Contamination of cell lines/tissues	1
Lack of irb/iacuc approval	10	Duplicate publication through error by journal/publisher	1
Author unresponsive	9	Error in cell lines/tissues	1
Error in methods	9	Falsification/fabrication of results	1
Investigation by ori	9	Lack of approval from company/institution	1
Upgrade/update of prior notice	9	Lack of approval from third party	1
Concerns/issues about results	8	Retract and replace	1
Euphemisms for plagiarism	8	Error in text	1
plagiarism of text	8	Plagiarism of data	1
Withdrawal	8	Salami slicing	1
Fake peer review	8	Manipulation of results	1
Date of retraction/other unknown	7	Updated to retraction	1
Duplication of data	7	Concerns/issues about referencing/attributions	1
Error in analyses	7	Conflict of interest	1
Ethical violations by author	7	Copyright claims	1
False/forged authorship	7	Misconduct by company/institution	1
Informed/patient consent - none/withdrawn	7	Notice - no/limited information	1

Table 5 shows the reasons for retraction among the retracted papers in immunology. Some articles have been retracted only for one reason and some for various reasons. The main reasons for the retraction of immunology articles were Investigation by Company/Institution (N=59), Duplication of Image (N=49), Misconduct by Author (N=41), Unreliable Results (N=31), Falsification/Fabrication of Data (N=30), and Misconduct – Official Investigation/Finding (N=30).

Discussion

Retraction is how articles are removed from journals, databases, and other platforms (10). Articles could be retracted for various reasons, such as plagiarism, fabrication, falsification, duplication, and the like (20). Retraction of an article shows that the research results could not be more precise and reliable, so they should not be used for further research and can potentially harm patients (21). This research was done to investigate retracted immunology articles. The impact of retracted articles in immunology can be analyzed using scientometric techniques to identify areas for improvement in the scientific publishing process, and the authors will have a better understanding of the impact of these articles on the field of immunology. Retraction is crucial to maintain the integrity of scientific research and prevent harm to public health

and patients (22). Thus, it is essential to know these articles. The goal of the research was to conduct a comprehensive investigation of the characteristics of retracted articles in the field of immunology. The study identified 240 retracted papers from the immunology category of the WoS database. This research found that the number of retracted papers in immunology has been increasing over the last few years. Other studies in various fields, such as Pantziarka and Meheus (23), Bozzo et al. (24), and Gholampour et al. (5), have also shown an increase in the number of retracted articles in the last decade. As mentioned, the number of citations to retracted immunology articles is high. Similarly, other research results showed that citation of retracted articles continues after retracting (25-27). One thousand one hundred seventy-six authors were involved in producing retracted immunology articles. Of these, 11 authors wrote articles individually, and the percentage of international co-authorships was 18.75%. The study findings demonstrated that Thomas JM and Pease LR, with eight and seven articles, contributed more to creating retracted articles. The first set of guidelines for editors on publishing retractions was released by the Committee on Publication Ethics (COPE) in 2009; the guidelines have made journal editors more aware of this problem to prevent the creation of retracted publications, authors and journal



editors should follow these guidelines (6). China and the United States made more significant contributions than the other countries to produce the retracted immunology articles. Similar to the present findings, Mena et al. found that the USA and China have the most retracted publications (10). The results of this study highlighted that immunity, interferon-gamma, oxidative stress, nf-kappa-b, cells, gene expression, epithelial cells, and protein are the topics commonly used in retracted papers in immunology over the last ten years. In this research, most of the retracted immunology articles had been published in journals with quartile 2. Also, Rubbo et al. concluded that most retracted articles were published in top-quartile journals (28). Therefore, journals with a higher quartile are stricter in retracting articles. Investigation by company/institution was the most common reason for retracting immunology articles in this study. The results of Samp et al. in Drug Literature (29) and Mena et al. in Urology (10) showed that Unethical author conduct and plagiarism was the most common reason for retracting articles, respectively.

The research's limitations were that only the WoS database was examined in the present study, while it would have been better to collect and examine the data related to the Scopus and PubMed databases. Second, the WoS database and the Retraction Watch database are two different databases that may have only some articles indexed simultaneously in these two databases. Eventually, by knowing the reasons for retracting and examining retracted articles, it was found that these articles are on the rise, and citing them in other research makes them more visible. As mentioned, since the publication of retracted articles can cause harm to the health of society and patients, journals and researchers should be more diligent in preventing the publication of such articles. It is advised that in future studies, retracted articles on immunology be evaluated and assessed using altmetrics to ascertain the amount of their use by the scientific community and the general public.

Conclusion

Analyzing retracted immunology publications and looking into the causes of retraction are the goals of this work. In the Web of Science database, 240 immunology publications that had been retracted were discovered. The most retracted immunology publications were published in the journals "Journal of Immunology" and "International Immunopharmacology". The most retracted immunology articles were published

in top quartile journals. Thomas JM, Pease LR, and Radhakrishnan S, were the authors whose contributions to retracted immunology publications were the most significant. Compared to other Institutions that published immunology articles, Univ Texas produced the most retracted immunology articles. Regarding the countries that played a role in the production of retracted immunology articles, China and the United States had a greater share in the production of immunology retracted articles. The most keywords plus that were used in the retracted immunology articles were expression, activation and inflammation. Also, the most reason for retracting immunology articles was "Investigation by company/institution". The results of this research showed that retracted immunology articles are increasing, and different authors, countries, journals and universities have played a role in producing such articles. Research ethics rules aid researchers in producing and disseminating authentic publications, hence it is advised that writers are familiar with their contents, to prevent the publication of these articles.

Declarations

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Declaration of interest

The authors declare they have no conflict of interest with respect to this study.

Ethical statement

All ethical issues have been observed by the authors in all stages.

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Authors' contributions

'Hami A' designed this work. 'Khazae Nasirabadi MH', 'Hami A' and 'Niazi MJ' wrote this manuscript. All authors contributed to the article and approved the submitted version.

Data availability

Authors guarantee that data of the study are available based on request to the corresponding author.



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