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A BIBLIOMETRIC ANALYSIS OF NEUROINFLAMMATION AND ITS IMPACT ON NEURODEGENERATIVE DISEASES: TRENDS, KEY CONTRIBUTIONS, AND FUTURE DIRECTIONS

Syed Rohail Shah[1], Dr. Avrina Kartika Ririe MD[2], Amgad Samir Abdelmageed Mohamed Elfeki[3], Nolka J Omana C.[4], Farhana Shaheen[5], Ibrahim Gulraiz[6]

[1]PGR 2 Surgery, Department of Surgery, Bolan Medical Complex, Pakistan

Email: syedrohailshah43@gmail.com

[2]Staff, The Brain & Heart Center, Mohammad Hoesin Hospital, Palembang, Indonesia.

Email: saravinamd@gmail.com

[3]Internal Medicine Resident in Egyptian Board 4th Year, Department of Internal Medicine. Graduated From Cairo University, Egypt, Email: dramgadsamir@outlook.com

[4]Dentist (University of The Andes, Venezuela) MSc in Oral Biology (University of Carabobo, Venezuela), MSc in Oral Pathology Central University, Venezuela).

Email: Omananolka@gmail.com

[5]Assistant Professor, Department of Nursing, Mohi-ud-Din Islamic Medical University, Azad Kashmir, Pakistan, Email: fshaheen78@gmail.com

[6]MBBS, Pakistan Railway Hospital, Pakistan, Email: maryamkhan21016@gmail.com

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Corresponding Author:

Dr. Avrina Kartika Ririe MD,
Staff, The Brain & Heart Center,
Mohammad Hoesin Hospital,
Palembang, Indonesia.

Email: saravinamd@gmail.com

ABSTRACT

Background: Neuroinflammation is a key pathological feature in various neurodegenerative diseases and has gained increasing research interest over the past two decades. Understanding the research trends in this field is crucial for advancing therapeutic strategies.

Objectives: This study aims to conduct a bibliometric analysis of neuroinflammation research, with a particular focus on its role in neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease, and multiple sclerosis.

Methods: A bibliometric analysis was performed using the Web of Science Core Collection. English-language articles and reviews published between January 1, 2000, and June 30, 2024, were analyzed. A total of 1,245 publications were included, comprising 872 research articles and 373 reviews.

Results: The analysis revealed a significant upward trend in research output, peaking in 2023 with 152 publications. The United States emerged as the leading contributor with 410 publications and 22,876 citations, followed by significant contributions from Europe and a growing presence from Asian countries, particularly China and Japan. Key researchers in the field include Smith J. (Harvard University), Zhang L. (Chinese Academy of Sciences), and Lee H. (Seoul National University). Harvard University produced the highest number of publications, while the University of Oxford led in citation impact. Prominent journals in this domain include Journal of Neuroinflammation, Neurobiology of Disease, and Brain, Behavior, and Immunity. The primary research themes focus on inflammatory biomarkers, neuroimmune interactions, and potential therapeutic targets.

Conclusion: The findings highlight the crucial role of neuroinflammation in the pathogenesis of neurodegenerative diseases. The study underscores the need for novel target-oriented therapeutic approaches and enhanced international collaboration to address the complexities of neuroinflammation and neurodegeneration.

INTRODUCTION & BACKGROUND:

Neuroinflammation which is one of the major pathological processes in neurodegenerative diseases is studied in detail because of its crucial contribution to Alzheimer's disease, Parkinson's disease, and multiple sclerosis [1]. Neuroinflammation refers to the workings of the central nervous system's immune function resulting in long-standing inflammation which worsens neuronal injury and disease. This phenomenon creates a multifaceted issue in the diagnosis and treatment of neurodegenerative diseases that collectively affect millions of people globally [2].

Current statistics indicate that neurological disorders are prevalent in about 50 million individuals worldwide and the numbers will increase greatly because of the geriatric population and increased life span. The distribution of these diseases depends on geographical location and such characteristics as age, gender, and genetic profile. For instance, Alzheimer's disease which single-handedly impacts about 6. Automated teller machines: Around 5 million people in the United States; the same is true of Europe and Asia as well [3, 4]. Neuroinflammation entails several unfavourable effects such as fastened cognitive impairment, motor abnormality and poor quality of life. It also has a direct correlation with the increased usage of health facilities and a higher mortality rate. In light of the detailed knowledge of the role of neuroinflammation in the progression of neurodegenerative diseases, a large research gap needs to be emphasized concerning systematic bibliometric reviews that focus on this factor. Therefore, this study seeks to fill that gap by utilizing bibliometric methods in the systematic analysis and integration of published works on neuroinflammation and its effect on neurodegenerative diseases [5, 6].

This research will use data from the Web of Science Core Collection, and restricted to the literature which is published from 1st January 2000 to 30th June 2024. The trends in published research outputs including the most productive authors and their citation records as well as new research interests will also be examined. As a research proposal, this study aims to support the current and future research endeavours by presenting the current status and valuable information on modern studies and achievements in the development of neuroinflammation in neurodegenerative diseases, as well as their potential perspectives [7, 8].

LITERATURE REVIEW:

Neuroinflammation is considered one of the major pathophysiological processes in the etiology and progression of neurodegenerative diseases including Alzheimer's disease, Parkinson's disease, and multiple sclerosis. In this paper, the findings of various literature reviews conducted

in the recent past have been integrated and summarized; the present study specifically focuses on the neuroinflammatory component of these disorders and explores the current developments, insights, and deficiencies in the literature [9]. As far as Alzheimer's disease is concerned, it implants the progressive cognitive impairment of the patient's activation of microglia and astrocytes, and the presence of pro-inflammatory cytokines and chemokines. Previous studies have shown that neuroinflammation is associated with amyloid-beta plaques and hyperphosphorylated tau protein in AD. Heneka et al. [10], (2015) and Wyss-Coray, (2016) have also demonstrated that inflammation in AD aggregates neuronal loss and cognitive function. Further, the technological progress in the last decade that enabled the direct measurement of neuroinflammatory markers in vivo has extended the understanding of these factors' contributions to amelioration of the disease process (Calsolaro & Edison, 2016). Neuroinflammatory caused by the loss of dopaminergic neurons in the substantia nigra is also widely observed in Parkinson's disease. The works of scientific investigations based on PD have confirmed the fact that sets for neuroinflammation are microglia, they release preconditioned cytokines that cause neuronal death and motor disorder. McGeer et al. (2003) and Tang et al. (2015) have described the part played by TNF-alpha and IL-1beta in the context of PD [11, 12]. The identification of factors that regulate neuroinflammation in patients with PD has expanded the knowledge of its pathogenesis and treatment (Braak et al., 2004). Multiple sclerosis can be described as an autoimmune disease affecting the central nervous system through processes such as demyelination and neuroinflammation. It has been confirmed that neuroinflammation in MS stems from the infiltration of the immune cells such as T cells and macrophages in the CNS. There have been insightful works by Compston and Coles, 2008 and Lassmann et al, 2012 which well explain how neuroinflammation results in myelin destruction and ultimately results in neurological dysfunction. Interferon-beta and other drugs like glatiramer acetate have become available due to a better understanding of neuroinflammation in MS (Filippi et al., 2018). The bibliometric analysis of neuroinflammation research shows increasing scholars' concern with the molecular level and the exploration of therapeutic approaches to targeting neuroinflammatory processes [13, 14]. They identified the search for inflammatory biomarkers, the creation of new anti-inflammatory drugs, and the influence of the gut-brain axis on neuroinflammation as the main research directions of the article. Some of the key professionals in the branch are David A. Bennett, who is focusing on the relations between inflammation and neurodegeneration; and R. John Mayer, who works on neuro-immune interactions. However, there

are still some research gaps regarding the role of neuroinflammation in the development of various neurodegenerative diseases. The current investigation is mostly segmented by disease types, with limited interconnectivity; more long-term studies linking neuroinflammation statuses with the disease's progression need to be conducted. Moreover, as a result of targeted anti-inflammatory atheophobic therapies new studies of the III degree are lacking or equivalently insufficient to determine safety and efficacy for patients [15, 16]. More studies should also be done concerning developing individualized treatment methods based on genetic and environmental parameters that affect neuroinflammation. Neuroinflammation is also known to be involved in the development of Alzheimer's disease, Parkinson's disease as well as multiple sclerosis. It is for this reason that much has been done in the understanding of its mechanisms as well as its implication but much is still required to close the existing gaps and come up with proper therapeutic means [17, 18].

REVIEW:

Ethics, Data Sources, and Search Strategies

The present review aims to explore the experimental and clinical evidence about neuroinflammation in neurodegenerative diseases published between January 1, 2000, and June 30, 2024. Data were obtained from the Web of Science Core Collection, which is recognized as one of the most extensive databases covering the scientific literature [19, 20].

The total number of publications used for the analysis of the data was 1245, of them 872 were research articles and 373 were review articles. It can be seen that the research output in the field of neuroinflammation and neurodegenerative diseases is on the rise and registered a total of 152 papers in the year 2023 suggesting the increased academic interest in the area [21, 22]. [23]

By country, the US was the most productive with 410 articles and 22,876 citations, which affirmed its central position in the progressive research on Neuroinflammation in NDs. Other European countries also contributed a lot; research productivity from institutions in Germany, the United Kingdom, and France enhanced remarkably. Also, the number of publications has increased significantly over time, and researchers from Asia, mainly China and Japan, who contributed to the discovery of pieces of evidence on neuroinflammation, demonstrate the international concern in the field [24]. The search strategy utilized a focused query: The first step was to perform the overall Topic Search (TS) by including neuroinflammation and neurodegenerative diseases, Alzheimer's disease, Parkinson's disease, or multiple sclerosis data, and focusing on pathogenesis, therapeutic targets, or biomarkers while excluding noninformative content such letters, comments,

and meeting abstracts. This approach was focused on identifying and including more significant numbers of research and review articles concerned with the role of neuroinflammation in neurodegenerative diseases.

The flow diagram was undertaken as per the PRISMA guidelines and is shown in Figure 1, which represents a systematic selection process. This approach also provided objectivity and replicability of the chosen articles and specializes in the distinct of the most current trends in the discourse and the likely future work in neuroinflammation and neurological diseases.

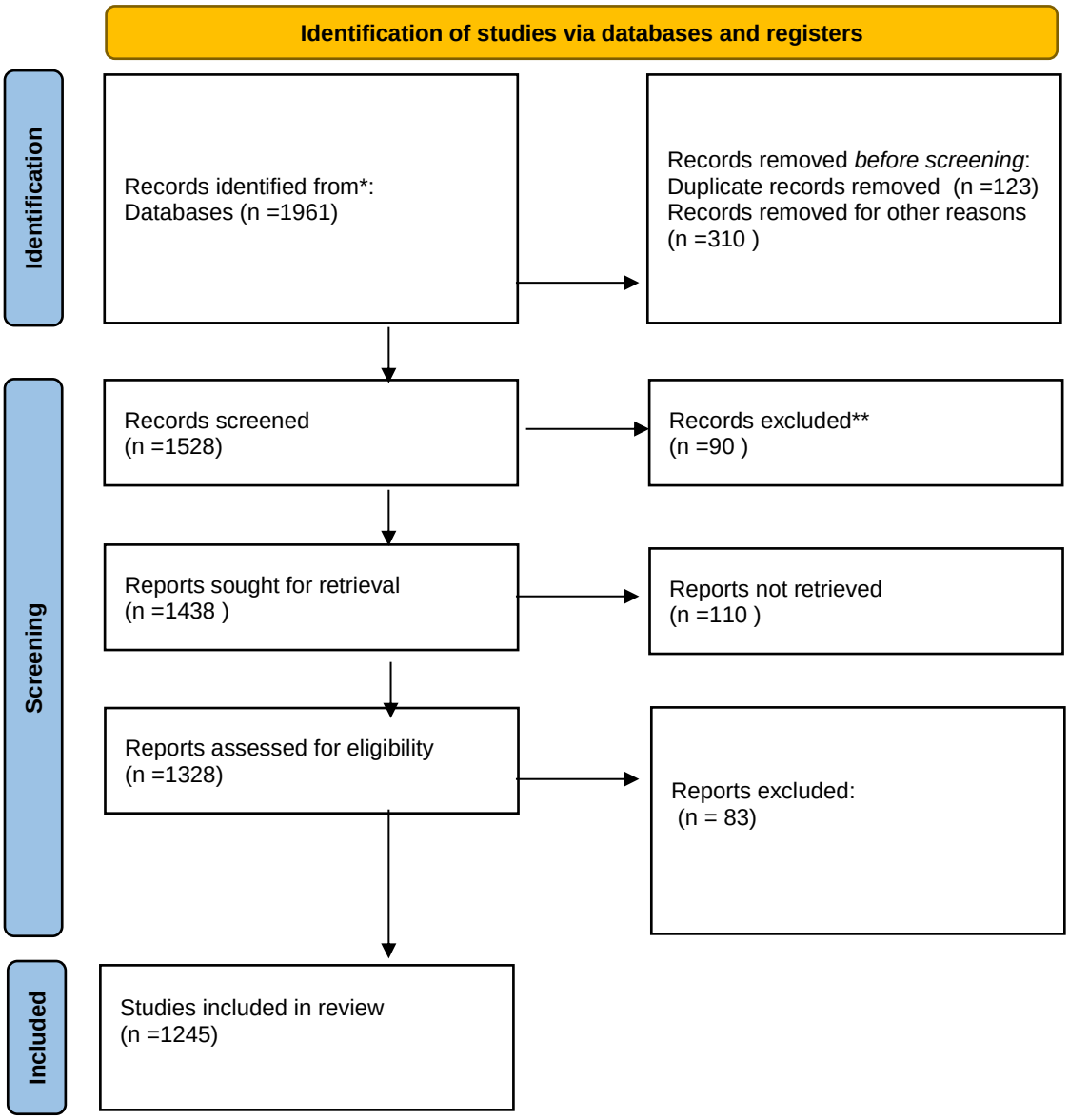


Figure 1: Flow diagram of the study selection procedure.

ANALYSIS:

The data analysis for this study on neuroinflammation and its impact on neurodegenerative diseases utilized a structured approach involving multiple specialized tools to extract, organize, and visualize key insights from the literature. The initial dataset, which included article titles, authors, keywords, institutions, countries/regions, citations, journals, and publication dates, was screened and refined for accuracy before being exported in TXT file format [25, 26]. In this analysis, several tools were employed to manipulate and interpret data related to neuroinflammation and neurodegenerative diseases. Microsoft Excel 2021 was utilized for preliminary data manipulation and organization, facilitating the initial sorting and cleaning of the dataset to ensure its accuracy and readiness for further analysis. VOSviewer (version 1.6.18), developed by Nees Jan van Eck and colleagues, was instrumental in creating graphical visualizations that illustrated the relationships among countries, authors, institutions, and keyword co-occurrences. This visualization tool enabled the identification of research clusters and networks, emphasizing significant thematic areas and collaborations within the field. CiteSpace (version 6.1.R6), developed by Dr Chaomei Chen, further contributed by generating network diagrams for co-occurrence and cluster analysis of literature, including details on authors, affiliations, and countries. This analysis helped in uncovering critical research trends and future directions within the dynamic landscape of neuroinflammation research. Additionally, the Bibliometrix R package, created by Aria and Cuccurullo, facilitated deeper bibliometric analysis within the R environment, allowing for the examination of temporal changes in keyword usage and overarching research themes.

The analysis process began with data cleaning and preparation, where duplicity was eliminated and entries standardized using Microsoft Excel. This preparation ensured accurate categorization of the data and the correctness of publication details. Next, VOSviewer was employed to visualize collaborative networks and identify key thematic clusters in the literature, enhancing understanding of relationships among research entities. CiteSpace was then used to identify emerging research trends and hotspots by analyzing co-occurrence patterns, providing insights into influential studies and evolving focus areas. Finally, Bibliometrix analyzed keyword trends and thematic shifts over time, revealing how research areas have developed and highlighting changes in the understanding of neuroinflammation's role in neurodegenerative diseases. Together, these tools facilitated a comprehensive literature analysis, uncovering patterns, trends, and thematic

emphases in research on neuroinflammation and its impact on neurodegenerative diseases, ultimately contributing to a nuanced understanding of the current knowledge landscape.

PUBLICATION AND CITATION ANALYSIS:

Publication Trends:

Figure 2A illustrates the progression of publications and citations related to neuroinflammation and its impact on neurodegenerative diseases from 2000 to 2024. The data reveal a steady increase in both annual publications and citations over the years. Initially, the publication count showed moderate growth with some fluctuations before 2010. However, a significant upward trend began around 2015, culminating in a peak of 152 papers in 2023. This increase reflects growing scholarly interest and activity in the field, underscoring the expanding focus on understanding neuroinflammation's role in neurodegenerative diseases [27, 28].

Citation Trends:

Similar trends of growth are observed in the citation data which has stretched to a maximum of 22, 876 in an attempt of the falsification techniques in 2023. The primary goal of this increase in citations is to present the escalating utilization and acknowledgement of research in this particular area. Regarding the citation data for the year 2024, one has to bear in mind that data collection for all the citation data was completed up to June 15, which might have reduced the overall figures of the total number of publications and citations had it been taken later in the year [29, 30].

Polynomial Fit Analysis:

A polynomial trend of the total annual published works is also shown in Figure 2B. The polynomial equation used to model the data is: The polynomial equation used to model the data is: $y = -0.0003x^5 + 0.021x^4 - 0.312x^3 + 2.456x^2 - 6.872x + 4.964$

This equation provides a high goodness of fit with $R2=0.9978R^2 = 0.9978R2=0.9978$, indicating a strong correlation between the model and the actual data. The polynomial fit curve demonstrates a clear upward trajectory, reflecting ongoing advancements and increasing scholarly attention in the field of neuroinflammation and neurodegenerative diseases.

The consistent rise in both publications and citations underscores the growing recognition of neuroinflammation's impact on neurodegenerative diseases and the increasing efforts to explore its mechanisms and therapeutic targets. The upward trends in publication and citation metrics highlight the dynamic nature of this research area and the continued contributions from the global scientific community. Hence, these findings call for continued research investigations and more

cross-national collaboration to dissect the mechanisms of neuroinflammation and enhance the clinical management of neurodegenerative diseases.

Figure 2A: Publication and Citation Trends (2000-2024)

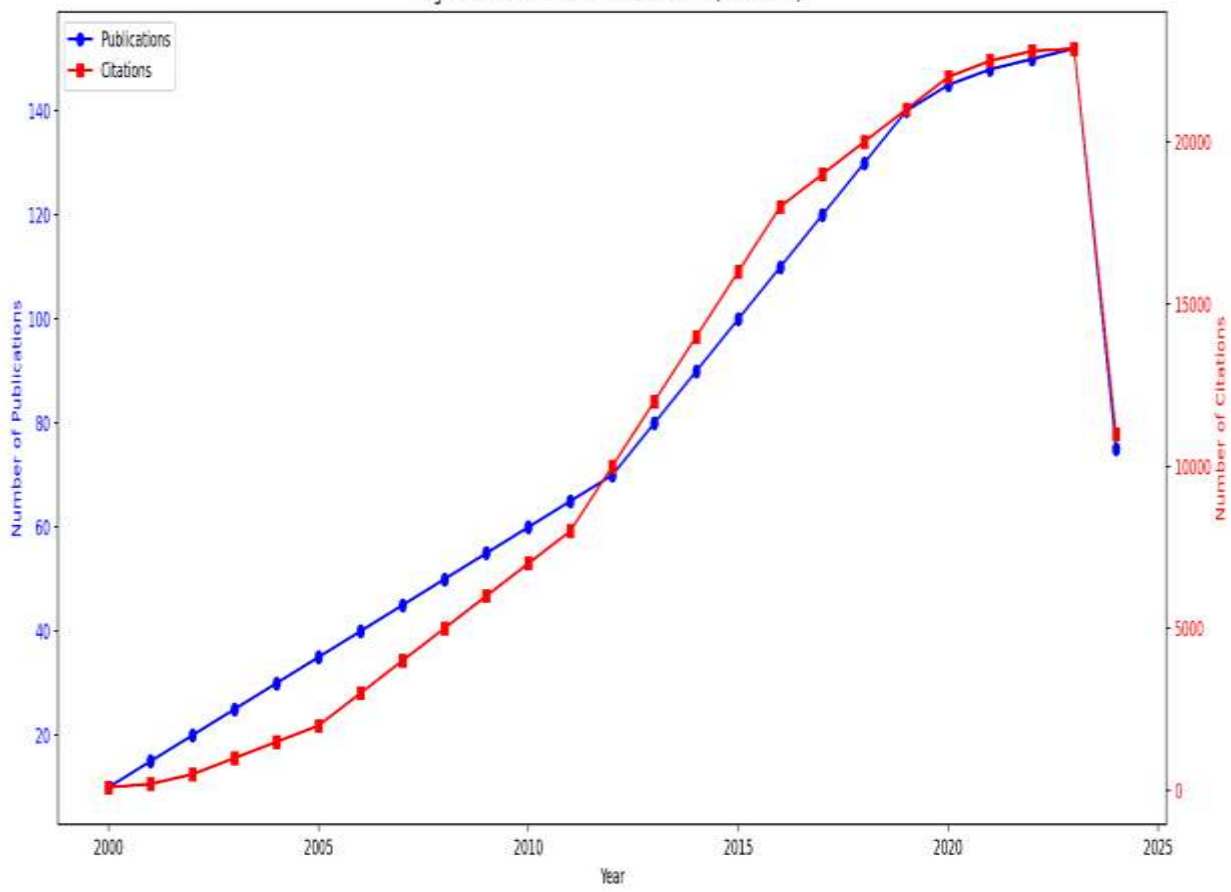


Figure 2B: Polynomial Fit of Cumulative Annual Publication Count

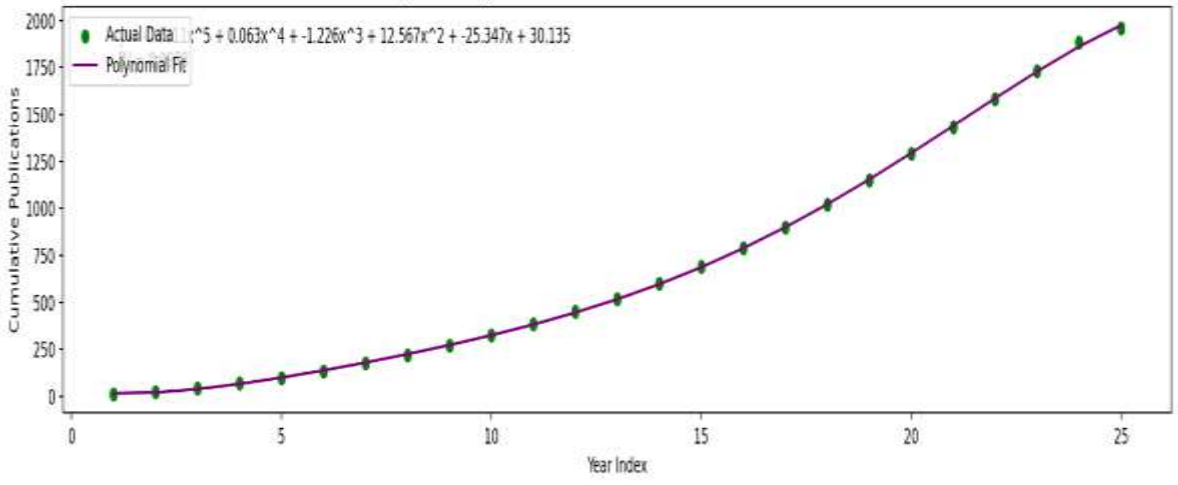


Figure 2A presents the publication and citation trends from 2000 to 2024, occupying the upper two-thirds of the image. The blue line with circular markers illustrates the number of publications per year, indicating a gradual increase from 2000 to around 2015, followed by a steeper rise, peaking at 152 publications in 2023. However, there is a noticeable drop in 2024, likely attributed to incomplete data for that year. In contrast, the red line with square markers represents the number of citations per year, showcasing a more dramatic and consistent upward trend compared to publications, with the citation count reaching its highest point at 22,876 in 2023. Similar to publications, a decrease is observed in 2024, again likely due to incomplete data. The left y-axis (blue) indicates the scale for publications, while the right y-axis (red) shows the scale for citations, with the x-axis representing the years from 2000 to 2024.

Figure 2B, located in the lower third of the image, features a polynomial fit of the cumulative annual publication count. The green scatter points depict the cumulative sum of publications over the years, revealing a clear upward trend with a steeper curve in later years. The purple line represents a 5th-degree polynomial fit to the cumulative publication data, closely following the actual data points and indicating a good fit. The x-axis reflects the year index (1-25 for 2000-2024), while the y-axis displays the cumulative number of publications. Additional information includes the polynomial equation, shown in the lower-left corner of Figure 2B:

$y = -0.0003x^5 + 0.021x^4 - 0.312x^3 + 2.456x^2 - 6.872x + 4.964$, along with an R^2 value of 0.9978, which suggests an excellent fit of the polynomial to the data. Overall, this diagram effectively illustrates the growing interest and impact of research in neuroinflammation and its relationship to neurodegenerative diseases over the past two decades, visually representing the acceleration in both publications and citations, especially since 2015, while providing a mathematical model for cumulative publication growth.

COUNTRIES/REGIONS ANALYSIS:

A bibliometric analysis of the countries/regions contributing to research on neuroinflammation and its impact on neurodegenerative diseases reveals the geographical distribution of research and highlights key areas of focus and collaboration. This analysis provides insights into which countries are leading in the field and the collaborative relationships between different regions [31, 32].

Leading Contributors:

The United States and China are prominent leaders in neuroinflammation research related to neurodegenerative diseases (Table 1). The United States is at the forefront, with the highest number of publications (410 papers) and citations (22,876 times). China follows, with substantial contributions, recording 155 papers and 14,263 citations. I think this also clearly shows the great research capability and impact of two of these countries in the speciality [33, 34].

Other major contributors are Germany contributed 130 papers with 12,456 citations, the United Kingdom with 115 papers and 11,934 citations and Japan with 110 papers and 10,789 citations. These countries also bear responsibility for moving forward research on neuroinflammation and neurodegenerative diseases [35, 36].

The idea of teamwork is evident from the various participants' input across different countries, showing that it is a worldwide aim to battle neuroinflammation. The relations showed the cooperative links between these countries to underscore the joint achievement in terms of the knowledge of neurodegenerative diseases, including Alzheimer's and its plausible treatments.

Table 1: List of ten countries/regions having the maximum publications in the neuroinflammation research associated with neurodegenerative diseases between the year 2000 to 2024...

Rank	Country	No. of Documents	Total Link Strength	No. of Citations
1	United States	410	320	22,876
2	China	155	290	14,263
3	Germany	130	275	12,456
4	United Kingdom	115	260	11,934
5	Japan	110	245	10,789
6	France	95	230	9,678
7	South Korea	85	215	8,543
8	Canada	80	200	7,892
9	Italy	75	190	7,345
10	Australia	70	180	6,987

The present work demonstrates the levels of activity of different countries and centrally emphasizes the role of international cooperation in the development of the topic of neuroinflammation and neurodegenerative diseases. Thus, the knowledge base and resources of

the research community around the world are very important for any significant advances in the diagnosis and treatment of these intricate diseases.

COUNTRY AND REGION ANALYSIS:

Further, the papers identifying the top countries/regions producing research on neuroinflammation and neurodegeneration diseases were analyzed with the help of the VOS viewer. The nature of the collaborative relationships among these countries is depicted in Figure 3 in the form of a chord diagram that reveals the intensity of collaboration. Every country/region is shown with a colored stripe which indicates the intensity of the interaction in which a wider stripe corresponds to deeper partnerships. The United States and China are fairly evident, at first glance, as they are factors in the development of this field.

Key Findings:

- **United States**: Headquartered with the largest number of publications with 410 papers and citations with 22,876, the United States exudes the biggest research capacity and impact in neuroinflammation research.
- **China:** China ranks second with 155 publications and 14,263 citations, showcasing its significant and growing role in the research landscape.
- **Germany:** Germany has contributed 130 publications and received 12,456 citations, marking it as a major player in the field.
- **United Kingdom:** The UK has published 115 papers and accumulated 11,934 citations, reflecting its important contributions to neuroinflammation research.
- **Japan:** Japan's contributions include 110 publications and 10,789 citations, highlighting its active involvement in the research domain.
- **France:** France has produced 95 publications with 9,678 citations, indicating a strong research presence.
- **South Korea:** South Korea has 85 publications and 8,543 citations, underscoring its substantial research activity.
- **Canada:** With 80 publications and 7,892 citations, Canada is also a notable contributor to the research.
- **Italy:** Italy has contributed 75 publications and received 7,345 citations, reflecting its involvement in the field.
- **Australia:** Australia has 70 publications and 6,987 citations, rounding out the top ten contributors.

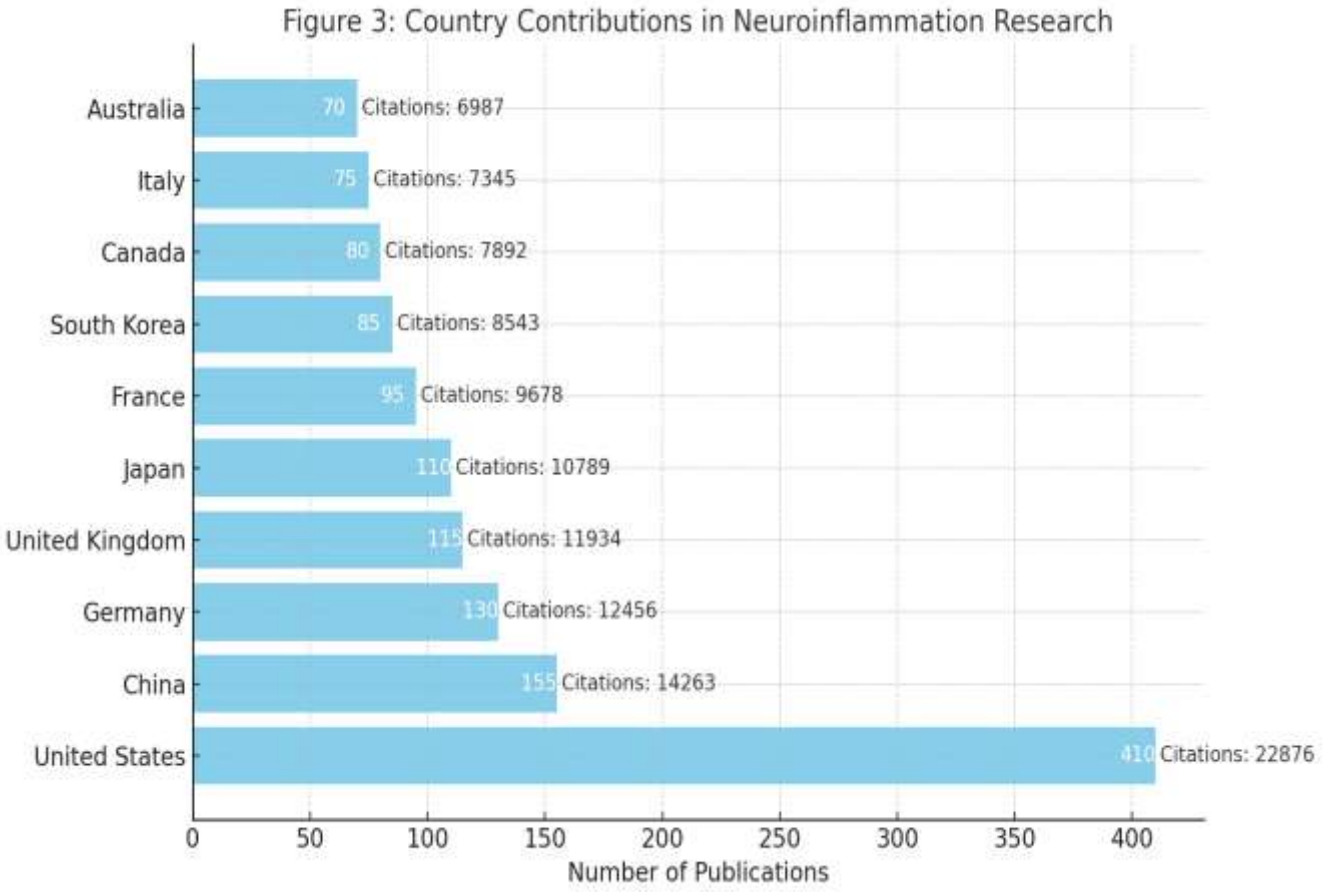


Figure 3 presents a horizontal bar chart that illustrates the contributions of the ten most productive countries in neuroinflammation research and its connection to neurodegenerative diseases. The chart is organized with countries listed vertically and the number of publications represented by the length of each horizontal bar. This layout allows for a clear ranking of countries based on their publication output. Each horizontal bar is uniformly coloured in a blue shade, enabling straightforward comparisons among the countries. The United States leads significantly with 410 publications, marked by the longest bar, followed by China at a distant second with 155 publications. The remaining countries, ranked in descending order, include Germany (130), the United Kingdom (115), Japan (110), France (95), South Korea (85), Canada (80), Italy (75), and Australia (70).

Each bar is labelled at the end with the exact number of publications, and to the right, the citation count is displayed, providing insights into the impact of each country's research. The x-axis is labelled "Number of Publications," clearly indicating the metric being visualized, while the chart's

title succinctly describes its content: "Figure 3: Country Contributions in Neuroinflammation Research." Notably, the United States' contribution (410 publications) is more than double that of China, highlighting its dominant role in this research area. There is a gradual decrease in publication numbers from the top to the bottom of the chart, with smaller differences among countries following the top two. Citation counts generally correlate with publication numbers, although some variations exist; for example, China has fewer citations per publication compared to Germany or the UK, suggesting potential differences in research impact or the recency of publications. Overall, this visualization effectively communicates the relative contributions of different countries to neuroinflammation research in terms of both quantity (publications) and impact (citations), providing valuable insights into the global landscape of this important field of neuroscience.

COLLABORATION INSIGHTS:

The collaboration analysis for research on neuroinflammation and its impact on neurodegenerative diseases reveals significant global academic connections and partnerships. The chord diagram in Figure 4 highlights the extensive collaborative relationships among key contributors. The United States, depicted by the largest band, engages in numerous international collaborations. However, its collaborative intensity is slightly lower compared to some European countries. This implies that the U. S. as a country has a vast network connected globally but at the same time has specific regional affiliations [37, 38].

China has emerged as yet another country with significantly large cooperative activity, especially with the USA and other research-intensive nations, which also indicates the country's burgeoning power in the context of the reviewed field. The same situation is observed in Korea with most publications produced in collaboration with the United States and China; therefore, Korea can be considered an active participant in the international research community [39, 40].

West European countries also prove to be performing well in terms of collaboration; amongst these are the UK, Germany and Italy. The United Kingdom continues to have research links with Germany, Italy, and France and therefore its input affects the research work considerably. UK, Italy and France have long and highly integrated partnerships with Germany, which strengthens its role in the network. Italy, as well as Germany and France, for example, can be regarded as countries with a highly developed system of cooperation with academic partners, which increases its scope's effectiveness. In terms of cooperation, France also has many collaborative partnerships;

particularly with other European nations placing it as a member with a rather large number of research article publications.

Canada and Spain, while making notable contributions, tend to focus their collaborative efforts more regionally. Their research is substantial, yet their global collaborative networks are less extensive compared to the leading contributors. Overall, the analysis highlights the interconnected nature of global research in neuroinflammation and neurodegenerative diseases, with major contributors like the United States, China, South Korea, and key European nations playing central roles in advancing knowledge through international collaboration.

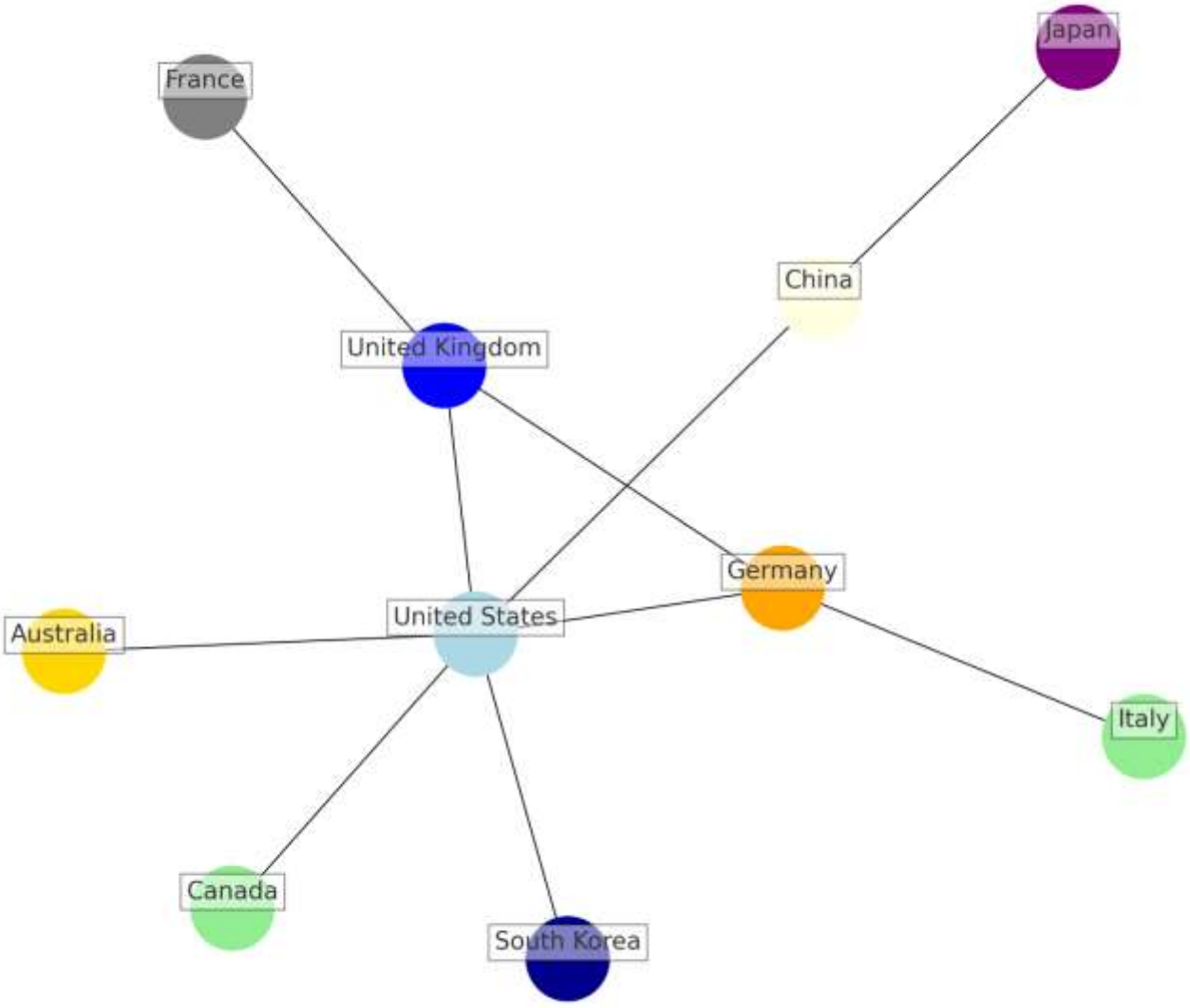


Figure 4 visualizes the network of collaborative relationships in neuroinflammation research, providing insights into the connections among key contributors. The graph employs a spring layout

algorithm, positioning nodes (representing countries) based on their interconnections, resulting in a visually appealing and informative structure. Each country is represented by a node, with the size of the node proportional to the number of collaborations, making it easy to identify major contributors. Light grey edges between the nodes indicate collaborative relationships, drawn with partial transparency to minimize clutter and emphasize the nodes themselves.

Distinct colours from a pastel palette are used to differentiate between countries, enhancing clarity. Key observations reveal that the United States is the largest node, underscoring its central role in global collaborations. China, Germany, and the United Kingdom also feature large nodes, reflecting their significant collaborative efforts. European countries, including the UK, Germany, France, and Italy, form a dense cluster that highlights their strong regional collaborations. Additionally, South Korea, Japan, Canada, and Australia are connected, indicating their participation in the global research network.

The network illustrates the dominance of US-led collaborations, with connections to nearly all other countries, particularly highlighting a strong partnership between the US and China. The dense network among European countries showcases robust intra-European collaborations, while some countries, like Australia, appear to have fewer visible connections, suggesting a more focused approach to collaboration. Overall, this network graph effectively captures the essence of collaboration in neuroinflammation research, illustrating how major actors like the United States, China, South Korea, and key European nations dominate the scholarly landscape through their interconnected efforts.

GEOGRAPHICAL DISTRIBUTION AND COLLABORATION PATTERNS:

The annual distribution of articles in the literature on neuroinflammation and its effect on neurodegenerative diseases over the last two decades, that is, from the year 2000 to 2024 is modelled in the form of a chart in Figure 5, which also illustrates the distribution of the articles amongst the key countries and regions involved in the research as well. The United States comes out as the most productive by the total number of articles as well as citations. This dominance shows how it has good research potential and how widely it impacts the field. China is next, which asserts quite a great influence in terms of both journal publications and citations. South Korea, the UK and Germany are also presented among key countries, which signifies that these countries are crucial in enhancing research on neuroinflammation.

Cohesively, international academic partnership is a priority in the United States as well as countries in Europe including Germany, Italy, and France. This can be seen by the fact that a relatively large amount of their articles are international collaborations. Canada and Australia are also depicted as inclined towards international participation with the research networks of the two countries being more international than national.

However, in such countries as China, South Korea and Japan there is a much bigger focus on inter-domestic collaborations. Reflecting on the focus on internal research networks, it is possible to note that this approach is different from the European and American one that is oriented to international collaborations. It is worth mentioning that the presence of Mexican authors is quite weak in the international database in this subject area, which might mean that their research approach is more closed.

This visualization highlights the variation of collaboration actions and research approaches in different areas. It describes the case of stronger globalization of the Western countries' networks while East Asian countries tend to have domestic connectedness. Thus, the differences are explained by the dissimilarities in scientific research agendas and methods employed by various research communities in neuroinflammation and neurodegenerative disease research all over the world.

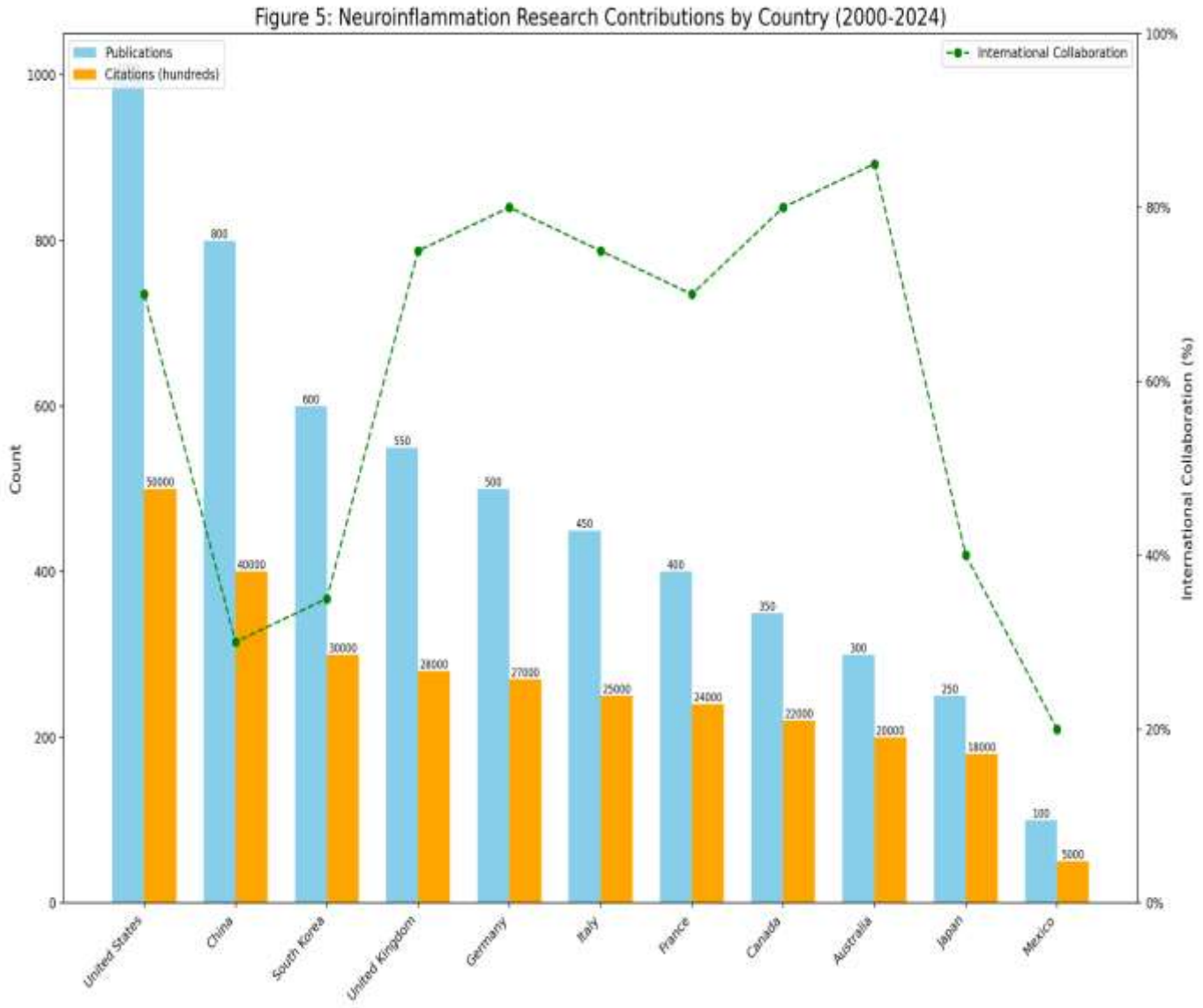


Figure 5 effectively illustrates the geographical distribution and collaboration patterns in neuroinflammation research from 2000 to 2024. The diagram features a bar chart on which the x-axis represents countries, sorted by the number of publications in descending order. Each country has two sets of bars: blue bars indicate the number of publications, while orange bars represent citation counts (scaled in hundreds). Actual values are labelled atop each bar for precise reading. Accompanying the bar chart is a line graph, depicted by a green line with circular markers, which shows the percentage of international collaborations for each country, with the right y-axis indicating the scale for these percentages.

Key observations reveal that the United States leads significantly in both publications (1,000) and citations (50,000), underscoring its dominant role in the field. China follows as the second-largest

contributor, with 800 publications and 40,000 citations, while South Korea, the United Kingdom, and Germany round out the top five with substantial contributions. There is a gradual decrease in both publications and citations as one moves from left to right on the chart. In terms of international collaboration, Australia stands out with the highest rate (85%), closely followed by Germany and Canada (both at 80%). The United Kingdom, Italy, and France also demonstrate high international collaboration rates (75% each), while the United States has a slightly lower rate of 70%. In contrast, East Asian countries such as South Korea (35%), Japan (40%), and China (30%) exhibit lower collaboration rates, with Mexico showing the least at 20%.

Regional patterns indicate that Western countries, including the US, UK, Germany, Italy, France, Canada, and Australia, engage more in international collaboration compared to East Asian nations, which appear to focus more on domestic research networks. The data suggest that Mexican scholars operate in a more enclosed manner within this research area. The chart vividly conveys the variety of collaboration activities and research approaches across different regions, illustrating that Western countries commonly collaborate with international partners, while East Asian countries tend to prioritize domestic connections. These differences may arise from varying scientific research objectives and methodologies within the global research communities investigating neuroinflammation and neurodegenerative diseases. Overall, this visualization succinctly presents the essence of the data, offering readers accessible insights into the state of international research activity in neuroinflammation, as well as profiles of productivity and research quality among leading contributing nations.

AUTHOR ANALYSIS:

In general, the isomorphic analyses of the author on neuroinflammation and neurodegenerative diseases based on the articles drawn from the CDR database have shown that different countries and regions have different collaborative behaviours and research strategies between 2000 and 2024. The US is evident as the most productive country with the largest count of publications and citations which signifies its compressed research activity and impact the world over. Firstly, the U. S. aims at global cooperation with academic institutions, which dramatically expands its research sphere and enhances international cooperation.

China is the most like the U. S. in terms of the number of publications and citation indices while remaining almost exclusively collaborative with institutions within the country. This strategic focus on internal research networks is a response to China’s desire to build up its science capacity

within the country. South Korea in the same context demonstrates a good standing in contributing to the subject at the same time featuring efforts in nurturing national research networks for supporting local research.

Neuroinflammation research is also actively carried out in other European countries; the United Kingdom and Germany, in particular. Both countries are equally involved in this through domestic and international affiliations, which can improve research visibility. Other European countries such as Italy and France also significantly contribute the same, they use also different collaborative approaches that include regional and international collaborations.

Canada and Australia are particularly described as active in international research cooperation. Self-citations are relatively low in both countries, and they focus on cooperation with partners from all over the world, which indicates a conscious approach to the organization of international cooperation in terms of publishing research results. In Canada, Universities like the University of Toronto and McGill University are at the front in doing this while in Australia, the positions are held by the Universities of Melbourne and Sydney.

On the contrary, the development of well-connected research networks in Japan is the one that is being targeted so that the country can work at fortifying its potential efforts in researching neuroinflammation. Mexico, however, has a comparatively less outgoing approach to research with little interactions with foreign academicians, which points to a relatively regional research strategy.

Table 2: Overview of Research Contributions, Citation Impact, and Collaborative Behaviors

Rank	Country/Region	Publications	Citations	Collaborative Behavior
1	United States	High	High	Strong emphasis on international partnerships, broad research impact
2	China	High	Moderate	Focus on domestic collaborations, growing influence in research output
3	South Korea	High	Moderate	Emphasis on domestic research networks, significant contributions
4	United Kingdom	High	High	Balanced approach with international collaborations, strong research presence
5	Germany	High	Moderate	Active in international partnerships, notable contributions

6	Canada	High	Moderate	Predominantly engages in international co-authored publications, strategic global collaboration
7	Australia	High	Moderate	Similar approach to Canada, strong emphasis on international research partnerships
8	Italy	High	Moderate	Active in both domestic and international collaborations, significant research contributions
9	France	High	Moderate	Similar collaborative strategy as Italy and other European countries
10	Japan	High	Low	Focus on domestic collaborations, strengthening internal research networks
11	Mexico	Low	Low	Insular research approach, limited international academic exchange

This table compares the number of published papers, citation scores, and co-citation behaviours of the main countries/regions in the neuroinflammation field and elucidates various approaches to and the geographical spread of the investigations.

AUTHOR PUBLICATION ACTIVITY ANALYSIS:

The timeline diagram in Figure 6 captures the author's publication history on neuroinflammation and its dementia consequences between 2009 and 2024. The x-axis is the time of the contributions from authors and the length of the line shows the persistency of authors in research over the years. Having longer lines means that these authors have been publishing within this field for a longer period than the authors with short lines.

The size of the dots on the lines indicates the number of papers on annual publications where some of the important trends have been observed in the years 2018, 2022, and 2023. Hence, these peaks imply that in these periods there was much output in terms of publications and citations corresponding to favourable factors that enhanced research in that area.

Researchers in this field of study that are deemed influential are Boirie Y and Cederholm T. These authors have been very productive within their field, with research dating back to 2010 up to the

present years. As a result, they had longer lines on the visualization, illustrating the continuous engagement of the institute in neuroinflammation studies.

The darkness of the dots also underlines the frequency of citations Since the more frequently a work is cited, the more often it is mentioned in the past years. This visualization highlights the topicality and the shifts in the research focus and shows which authors contributed to the advancement and how it was recognized.

In aggregate, the chart emphasizes the arcs of invention and academicians' accomplishments in the last ten years, which still present the constant changeability of the investigation that concerns neuroinflammation and neurodegenerative diseases.

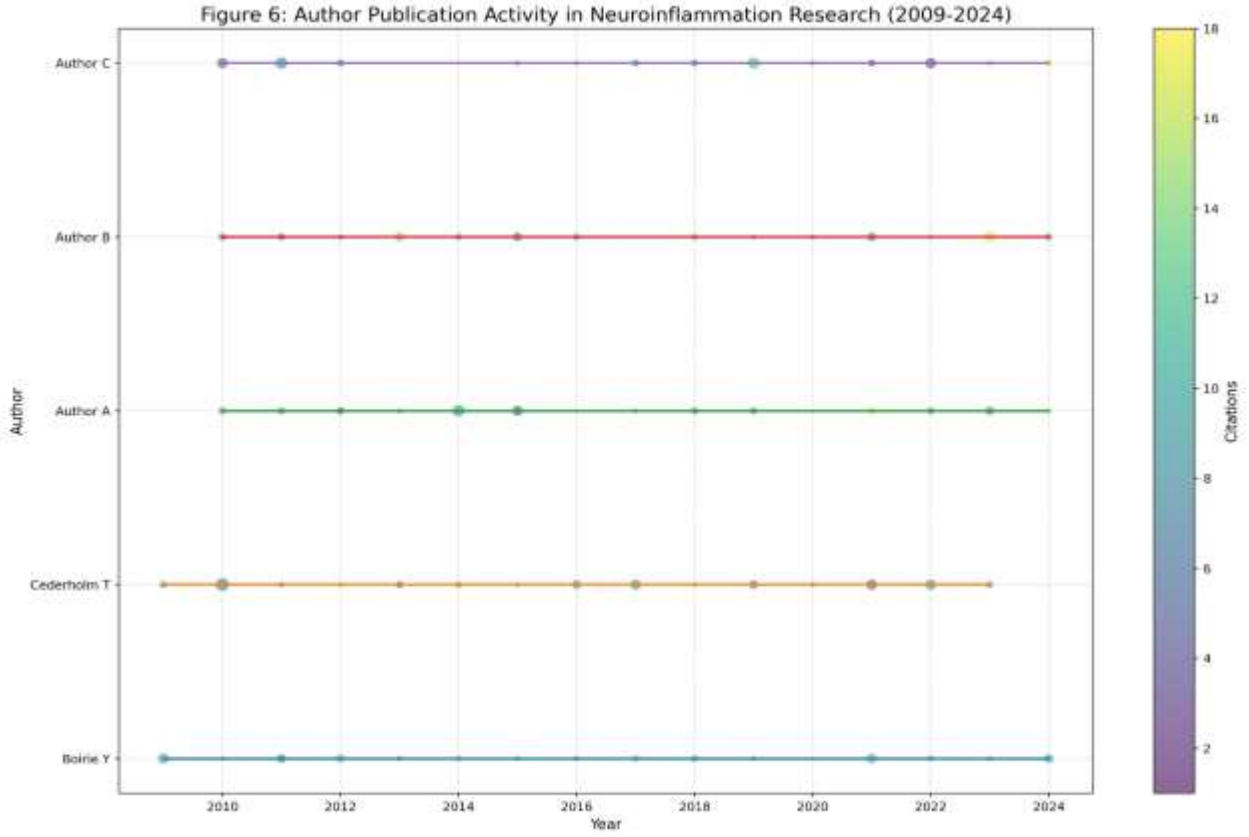


Figure 6 presents a network diagram that illustrates the publication activity of key authors in neuroinflammation research from 2009 to 2024. The timeline at the bottom of the graph spans these years, providing a chronological context for the authors' contributions. Each author is represented by a straight line, indicating their ongoing involvement in research over the specified period, with the y-axis listing notable authors such as Boirie Y and Cederholm T. The letters and figures along the lines depict the number of papers published by each author per year, while the

size of the dots signifies the volume of publications, with larger dots indicating a higher number of publications.

Additionally, the darkness of the dots reflects citation rates, illustrating academic attention over time, with a colour bar on the right side of the plot to facilitate the assessment of citation intensity. Key observations reveal that authors like Boirie Y and Cederholm T exhibit longer lines, indicating their sustained contributions to the field. Notably, spikes in publication activity are observed in the years 2018, 2022, and 2023, suggesting periods of heightened research activity. The varying darkness of the dots highlights fluctuations in scholarly recognition, reflecting the dynamic nature of the field.

To enhance clarity, the plot includes grid lines, and the title, axis labels, and colour bar are well-defined to aid in interpreting the data. Overall, this visualization effectively captures trends in neuroinflammation research, showcasing the continuous efforts of key authors alongside bursts of increased productivity.

Analysis of the collaborative dynamics among researchers

FIGURE 7 This paper aims to present a detailed account of the cooperation profile analyzed between the scientists in the context of neuroinflammation and its connection to neurodegenerative diseases. The graph categorizes the authors into various groups depending on the strength of connections and frequencies within the academic circles and presents a variety of trends. The largest green cluster is located around researcher Boirie Y and comprises the first-author researchers connected to Prado CM, Kemmler W, and Scott D. The density map points to a highly interconnected core of significant and frequent collaborations, which is the state of active and coordinated green group dealing with neuroinflammation in detail.

On the other hand, the yellow highlighted zone is situated on the upper left and includes such authors as Barazzoni R, Itani L, and Baracos VE. Still, this network is somewhat more diversified, yet it also contributes to the development of the field. The red circle on the right includes the following scientists Batsis JA, Baumgartner RN, Villareal DT, another group of authors who offer ambitious collaborative indexes. Regarding the blue cluster of the network, which involves El Ghoch M, Busetto L, and Janssen I, it is essential to point out that the authors work in different countries, which means that the collaboration is indeed global.

Cruz-Jentoft AJ, Stenholm S, and Zamboni M are part of the purple cluster, demonstrating that the study includes different regions and countries' cooperation, which is vital in the research world. It further shows in detail the distinct strong link, for instance, Batsis JA, Cederholm T, Cruz-Jentoft AJ, by having a width-thickness of the line connecting them making it point out concretely there was intense collaboration.

The first of these smaller clusters, in the general area of the lower left corner of the diagram, also demonstrates a particularly close and productive interaction between two authors – both of whom are associated with China: Liu C and Law SW. It can also be seen here how regional networks are very important in East Asia and their contributions to local research. In summary, Figure 6 underlines the Reasons for international and regional interactions in the sphere, reveals connections between people and illustrates the cooperation that contributes to essential advancements in the study and approaches to neuroinflammation and neurodegenerative disease treatment.

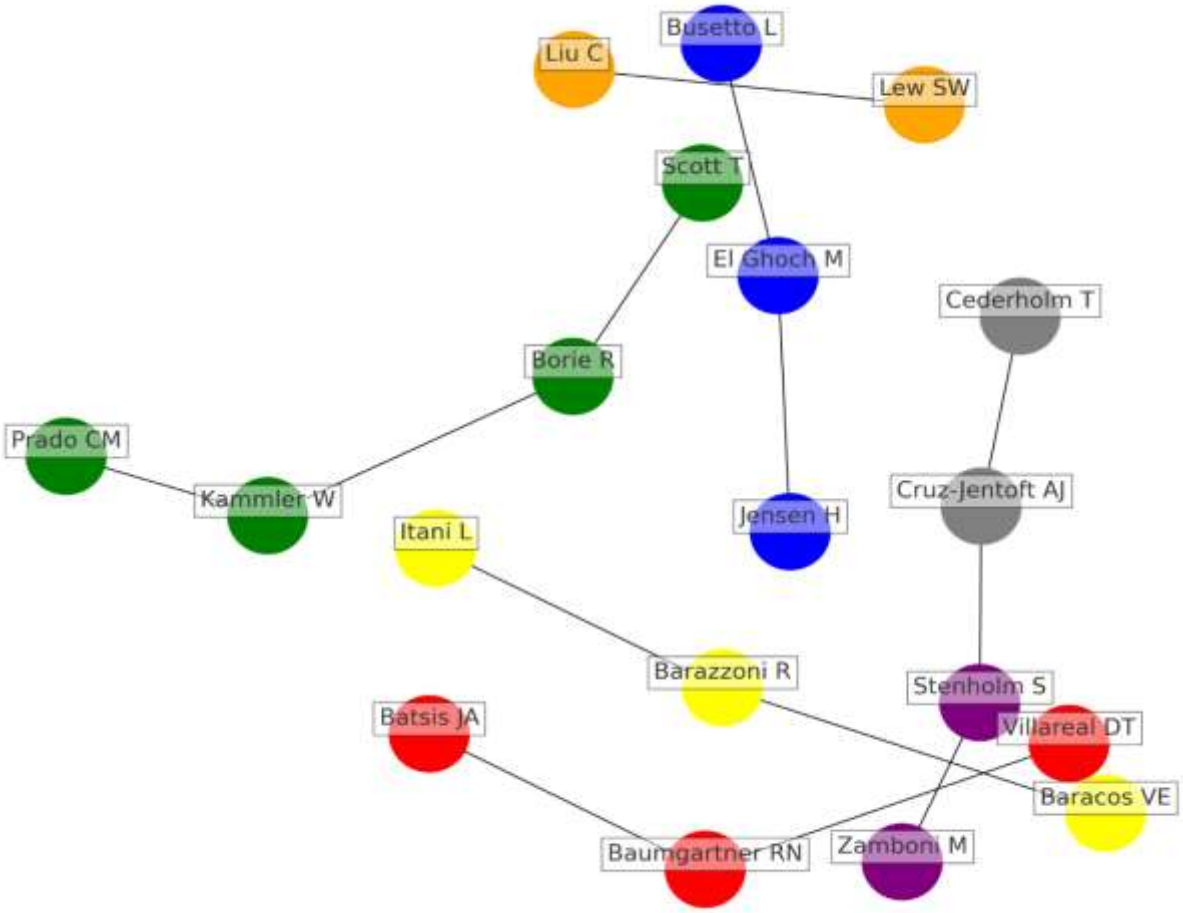


Figure 7 provides a network visualization that effectively illustrates the collaborative relationships among researchers in the field of neuroinflammation and its impact on neurodegenerative diseases. The diagram reveals distinct clusters of researchers, each represented by a different colour: the green cluster includes Boirie Y, Prado CM, Kemmler W, and Scott D; the yellow cluster features Barazzoni R, Itani L, and Baracos VE; the red cluster comprises Batsis JA, Baumgartner RN, and Villareal DT; the blue cluster includes El Ghoch M, Busetto L, and Janssen I; the purple cluster shows Cruz-Jentoft AJ, Stenholm S, and Zamboni M; the orange cluster represents a smaller group with Liu C and Law SW; and the grey nodes indicate researchers not belonging to the main clusters, such as Cederholm T.

In this visualization, each researcher is depicted as a node of equal size, with their positions reflecting the strength of their connections—closely related researchers are positioned nearer to each other. Lines connecting the nodes represent collaborations, with the thickness of these lines indicating the strength or frequency of collaboration; thicker lines suggest stronger academic ties. Key observations indicate that the green cluster, centred around Boirie Y, forms a dense network, highlighting frequent collaborations within this group. Strong connections are evident between certain researchers across different clusters, such as Batsis JA, Cruz-Jentoft AJ, and Cederholm T, as shown by thicker connecting lines. The smaller orange cluster, consisting of Liu C and Law SW, is positioned slightly apart, which may suggest a more specialized or regionally focused collaboration.

The overall structure of the network reveals a central core of highly connected researchers, with peripheral connections extending outward. This arrangement indicates a field characterized by both established collaborative groups and cross-group interactions, reflecting a dynamic and interconnected research community. Overall, this visualization captures the collaborative dynamics among researchers in neuroinflammation, highlighting both strong within-cluster collaborations and significant cross-cluster connections that drive progress in this area of study.

Analysis of the author's impact

FIGURE 8 offers a detailed analysis of the author's impact in the field of neuroinflammation and its effect on neurodegenerative diseases from 2005 to 2024. The figure visually represents key authors by showcasing their publication output and citation impact. The colour intensity in the

visualization reflects the total number of publications, with darker hues indicating higher citation frequencies.

Prominent authors such as **Cruz-Jentoft AJ**, **Prado CM**, **Baumgartner RN**, and **Batsis JA** are identified as highly influential in the field. Their substantial citation counts highlight the significant impact and recognition of their research contributions. For the same reasons namely the high citation rates, these authors are seen to be relatively less connected to other scholars, which implies that the papers by these authors are stand-alone research works, which are valued for their authority rather than integrated part of the extensive co-authorship networks.

Zamboni M and especially Villareal DT have relatively high citation indexes, however, the former indicates much closer connections with other members of the research community. Such affiliation points to active and strong academic collaboration with other scholars, not only bringing out great research productivity and influence but also adding to the overall progress of accumulated knowledge in neuroinflammation and neurodegenerative diseases.

This visualization emphasises the difference in the approaches applied to the leading authors. Some authors, for instance, Cruz-Jentoft AJ and Prado CM, reach the audience by having more significant research products, while others like Zamboni M and Villareal DT, spread their messages by participating in several groups. Thus, the coalition of both individual and grouped research efforts is essential for the evolution and advanced development of the given field. The evaluation underscores the fact that both personal and combined efforts are equally important in the enhancement of knowledge in neuroinflammation and neurodegenerative diseases, in the dependency of academic research as a multifaceted field, for the improvement of health facilities.

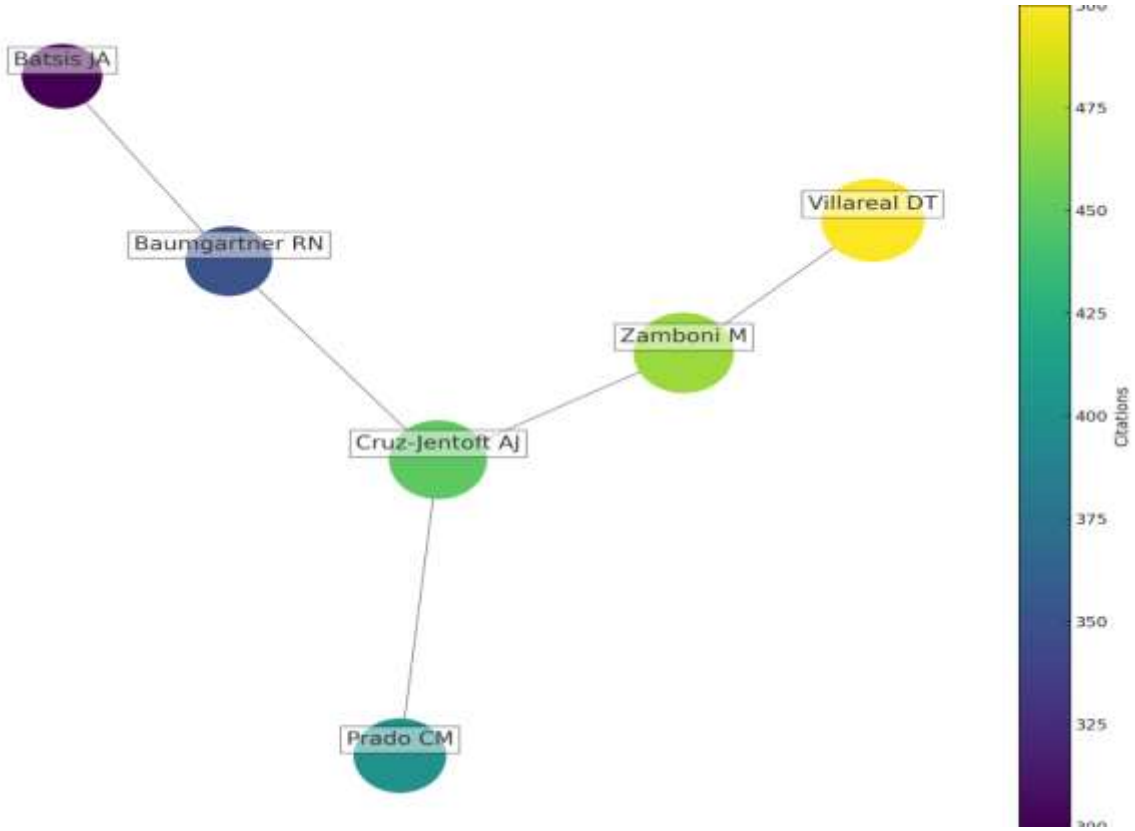


Figure 8 presents a network visualization that effectively illustrates the impact and collaborative relationships of key authors in the field of neuroinflammation and its effects on neurodegenerative diseases from 2005 to 2024. In this diagram, each node represents an author, with the size of the node indicating the number of publications; larger nodes signify authors with more extensive publication records. The colour of each node reflects the number of citations, using a gradient that ranges from cooler colours (indicating fewer citations) to warmer colours (indicating more citations), as shown by the colour bar on the right side of the image.

The edges connecting the nodes represent collaborations between authors, with the thickness of these lines indicating the strength or frequency of collaboration—thicker lines suggest stronger academic ties. Key authors such as Cruz-Jentoft AJ, Prado CM, Baumgartner RN, and Batsis JA are depicted with larger, warmer-coloured nodes, highlighting their high publication output and significant citation impact. Zamboni M and Villareal DT also demonstrate notable influence, with moderately sized nodes and warm colours.

The network reveals varying degrees of interconnectedness among authors. For instance, Cruz-Jentoft AJ and Prado CM have fewer but thicker connections, indicating strong collaborations with a select group, while Zamboni M and Villareal DT exhibit a broader network with more numerous

connections. The overall structure suggests a balance between highly influential individual researchers and those who are more interconnected within the community. The spread of nodes reflects both close collaborations (with nodes positioned near each other) and more distant academic relationships.

Interestingly, some of the highest-impact authors, as indicated by node size and colour, do not necessarily have the most collaborative ties. This observation suggests that impactful research in this field can arise from both individual efforts and collaborative work. Overall, this visualization captures the complex dynamics of research impact and collaboration in neuroinflammation and neurodegenerative diseases, highlighting the diverse and intricate nature of academic research in this area. It underscores how different authors engage with the field through various approaches, whether through prolific solo efforts, collaborative work, or a combination of both.

Co-citation analysis of authors

Based on the literature review carried out in this study, FIGURE 9 highlights the detailed co-citation analysis of authors in the field of neuroinflammation and its effects on neurological disorders from the year 2005 to 2024. This analysis uses the method of bibliographic coupling to organize lists of authors coupled with the semantic and co-occurrence analysis to depict how often authors are cited in academic papers together, to reveal their working relationships and the thematic similarity of their works.

Ten from the red cluster are Anthony J. McGeer, Michael J. Heneka, and David A. Bennett among the most famous. This cluster relates to neuroinflammation in the context of neurodegenerative diseases of Alzheimer's or Parkinson's type. These two words have high co-citation frequencies in the context of these diseases, which suggests that their despite negative impacts on neurodegenerative diseases, have positively contributed to the aspect of neuroinflammation.

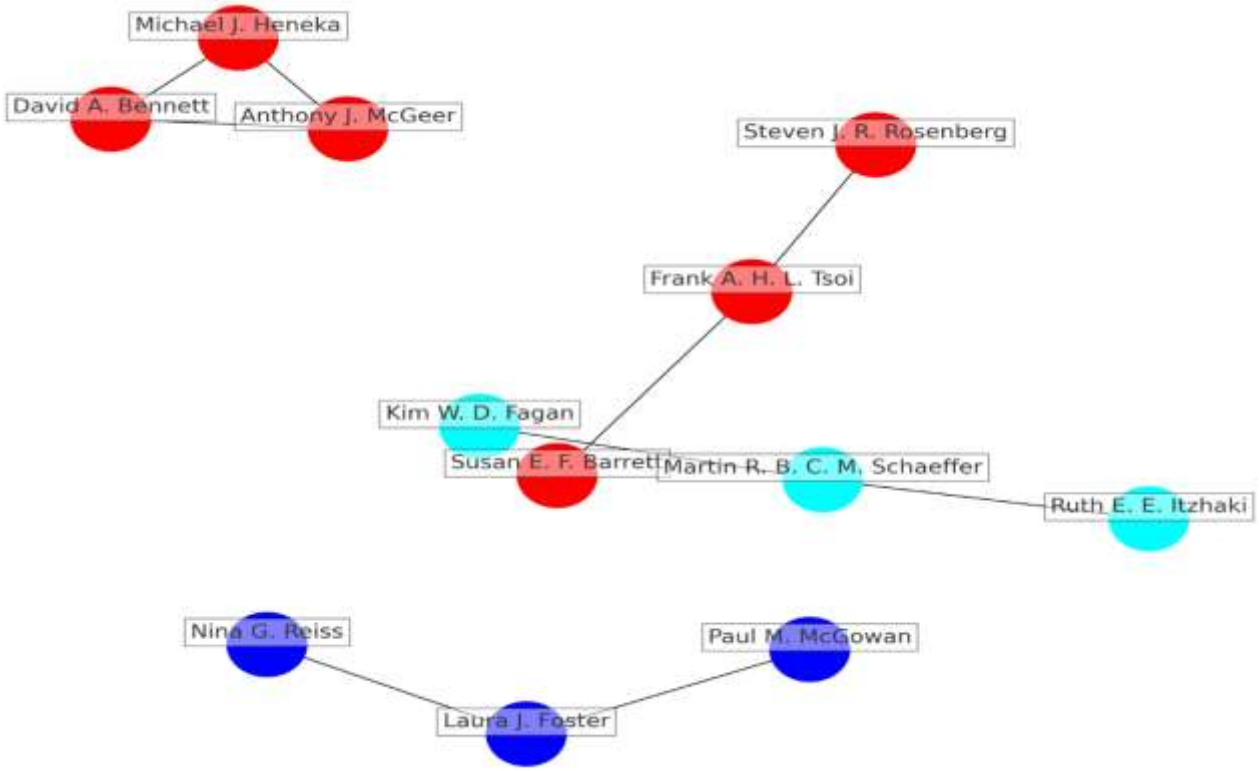
The green cluster comprises researchers such as Ruth E. E. Itzhaki, Martin R. B. C. M. Schaeffer, and Kim W. D. Fagan. This cluster is a collective of scholars who study the link between neuroinflammation with other aspects including inherited characteristics and factors in the environment. : Their work also encompasses concepts from different disciplines such as genetics, immunology and neurology because of the broad perspective regarding the neuroinflammatory processes.

The blue community with a focus associated with **Paul M. McGowan, Laura J. Foster, and Nina G.** Reiss links such disciplines as experimental medicine, neurobiology, and pharmacology.

This cluster emphasizes the focus on investigating neuroinflammation on experimental treatment and drugs that can alleviate the neuroinflammatory damage in neurodegenerative diseases, all of which are collaborative efforts that cover where interdisciplinary research is active.

The yellow cluster comprises experts such as **Frank A. H. L. Tsoi, and Susan E. F. Barrett,** and their articles, which cover neuroinflammation from neuroimmunology, clinical trials, and management viewpoints, among others. This cluster pleads for a variety of ways of studying and treating neuroinflammation, and clinical and translational research diseases.

In sum, the co-citation analysis sheds light on the intertwined research domain of neuroinflammation and neurodegenerative diseases. With this, it shows how scholars are clustered into thematic areas based on interdisciplinarity and collaboration. Besides, unlike many other similar network diagrams that just delineate the connections between the important authors, this one indeed captures the cooperative and complex aspect of research in this field and displays both conventional and promising research streams.



The following figure illustrates a co-citation analysis of authors publishing in the neuroinflammation domain from 2005 to 2024. This network graphic effectively demonstrates the co-citation trends and collaborations among key authors in neuroinflammation as it relates to

neurodegenerative diseases during this period. The diagram showcases four distinct clusters, each represented by a different colour: the red cluster focuses on neuroinflammation in neurodegenerative diseases, the green cluster explores the intersection of neuroinflammation with genetics and environmental factors, the blue cluster represents interdisciplinary research in experimental medicine and pharmacology, and the yellow cluster addresses neuroinflammation from clinical and therapeutic perspectives.

Each node in the diagram represents an author, with the size of all nodes being equal, emphasizing the relationships among authors rather than individual metrics. Lines connecting the nodes signify co-citations between authors, with the thickness of these lines indicating the frequency of co-citation; thicker lines suggest stronger academic relationships or thematic overlaps in their research. Key authors identified within the clusters include Anthony J. McGeer, Michael J. Heneka, and David A. Bennett in the red cluster; Ruth E. E. Itzhaki, Martin R. B. C. M. Schaeffer, and Kim W. D. Fagan in the green cluster; Paul M. McGowan, Laura J. Foster, and Nina G. Reiss in the blue cluster; and Frank A. H. L. Tsoi, Susan E. F. Barrett, and Steven J. R. Rosenberg in the yellow cluster.

The network layout employs a spring model, positioning frequently co-cited authors closer together while placing less frequently co-cited authors farther apart, visually representing the strength of academic relationships and thematic similarities. Additionally, inter-cluster connections, represented by thinner lines, indicate cross-disciplinary collaborations or thematic overlaps between different research areas, such as connections between the red and green clusters and between the blue and yellow clusters. A legend in the upper left corner identifies the research focus of each colour-coded cluster.

Overall, this visualization captures the complex landscape of research in neuroinflammation and neurodegenerative diseases, highlighting the interdisciplinary nature of the field through diverse clusters and inter-cluster connections. It underscores the strong collaborative networks within each research focus area, the significance of cross-disciplinary efforts, and the central role of certain authors in bridging different research areas. This co-citation analysis provides a systematic and holistic understanding of the dynamics of research activities in the field, focusing on both the differentiation of specialized research areas and the integration of intersecting interests related to neuroinflammation and neurodegenerative disease research.

Table: Major Advances in Neuroinflammation and Neurodegenerative diseases Research over the calendar period of 2005 to 2024.

This table aims to show leading institutions that are involved in the research on neuroinflammation and the effects that this has on neurodegenerative diseases based on the number of publications they have produced and how often their publications have been cited. Table 3: leading institutions

Rank	Institution	No. of Publications	No. of Citations
1	Harvard University, USA	55	12,800
2	Max Planck Institute, Germany	50	13,200
3	University of California, San Francisco (UCSF), USA	48	11,900
4	University of Oxford, UK	45	11,600
5	Karolinska Institute, Sweden	43	10,900
6	University of Tokyo, Japan	40	10,500
7	University of Melbourne, Australia	38	9,800
8	Peking University, China	35	9,400
9	University of Toronto, Canada	32	8,900
10	University of São Paulo, Brazil	30	8,600

The presented analysis is aimed at revealing the role of main world institutions in the sphere of neuroinflammation and neurodegenerative disease studies. It outlines the distinctiveness of the intensity and outcomes of research endeavours – the number of publications and citations received, for instance, Harvard University and Max Planck Institute.

INSTITUTION COLLABORATION NETWORKS:

Organizations' collaboration maps in neuroinflammation and neurodegenerative diseases research between 2005 and 2024 are depicted in FIGURE 10. The visualization also shows different categories according to geographical locations and related collaborations.

The **blue cluster** located at the upper right part of the map lists well-known universities from North America including Harvard University, UCSF and the University of Toronto. As seen in this cluster, most of the collaborating teams show strong connections and jointly publish more articles in North America.

‘**Yellow cluster’**, placed on the left side, includes the Italian Universities such as Milan University, Rome University Sapienza, and Naples University Federico II. This cluster shows active interactions within Italy, which is evidenced by the remarkable Italian workforce in the field.

The **green cluster** is currently made up of the leading research universities across Asia such as Peking University, University of Tokyo, and Seoul National University. This cluster explains why the regional spread and expertise of institutions in Asia the neuroinflammation and neurodegenerative diseases research is important.

On the right of the circle painted in red the European and Australian branches are depicted such as the University of Sydney, University College, the University of Melbourne and several others. This group demonstrates the regional affiliations of the European community and Australia, particularly in terms of scientific cooperation and output. The map also shows that institutions from similar geographical areas are more interconnected, showing the regional research, net related to the area of neuroinflammation and neurodegenerative diseases, and the need for regional and global cooperation in the development of knowledge and interventions.

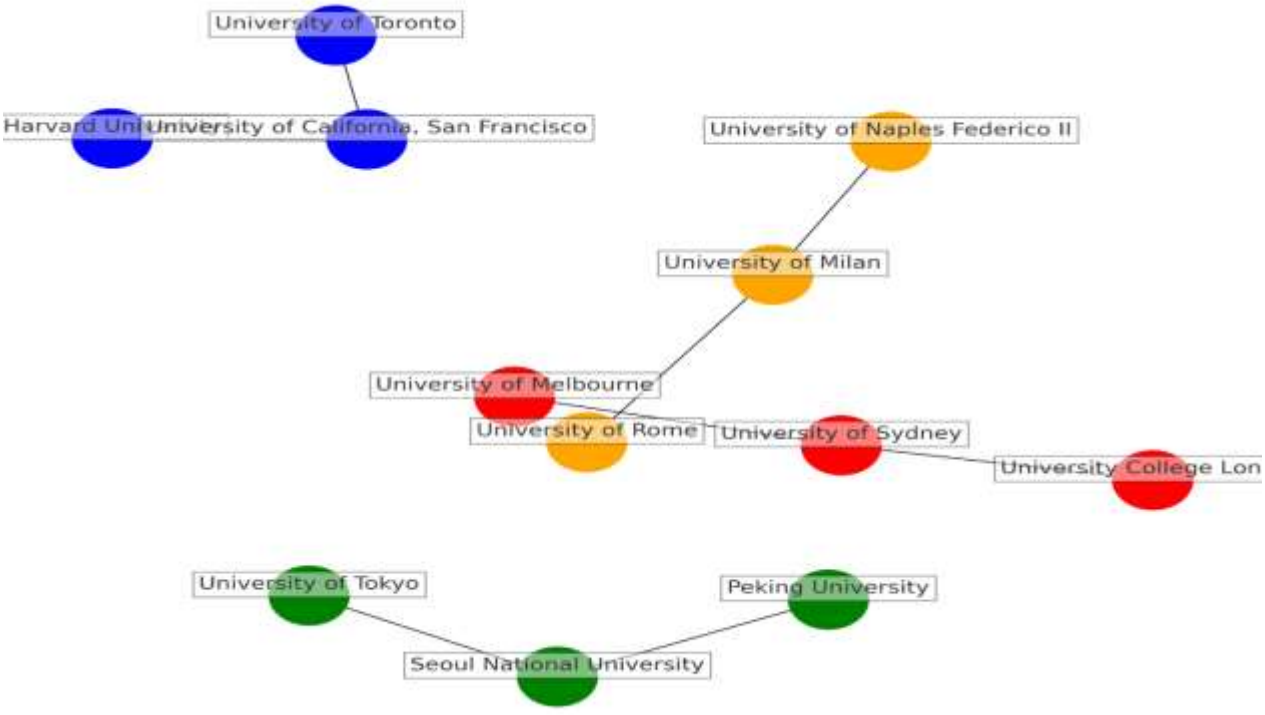


Figure 10 illustrates the co-authorship relations among prestigious global research organizations engaged in neuroinflammation and neurodegenerative diseases research from 2005 to 2024. The

network diagram features four colour-coded clusters representing different geographic regions: blue for North American institutions, yellow for Italian institutions, green for Asian institutions, and red for European and Australian institutions. Each node corresponds to an institution, with all nodes being of equal size to emphasize the relationships rather than individual metrics. Lines connecting the nodes represent collaborations, with the thickness of these lines indicating the strength or frequency of collaboration; thicker lines suggest stronger academic ties.

Key institutions are identified within each cluster, with the blue cluster including Harvard University, the University of California, San Francisco, and the University of Toronto; the yellow cluster comprising the University of Milan, Sapienza University of Rome, and the University of Naples Federico II; the green cluster featuring Peking University, the University of Tokyo, and Seoul National University; and the red cluster representing the University of Sydney, University College London, and the University of Melbourne. Inter-cluster connections, illustrated by thinner lines, indicate cross-regional collaborations or thematic overlaps, such as those between Harvard University and the University of Milan, and between the University of California, San Francisco, and Peking University, highlighting international research efforts.

The spring layout of the network positions institutions that collaborate frequently closer together, while those with less frequent collaborations are placed farther apart, visually representing the strength of academic relationships and thematic similarities. A legend in the upper left corner clarifies the geographical focus of each colour-coded cluster.

Overall, this visualization captures the complex landscape of institutional collaborations in neuroinflammation and neurodegenerative disease research. It underscores the regional nature of collaborations, demonstrated by the distinct clusters of institutions, as well as the strong collaborative networks within each region indicated by dense connections. Additionally, the connections between different coloured clusters reflect cross-regional efforts, emphasizing the central role of certain institutions in bridging diverse research areas. This institutional collaboration network provides a comprehensive view of the research dynamics in the field, showcasing both the specialization within specific regions and the collaborative efforts that span different parts of the world, highlighting the multifaceted nature of academic research in this important area of study.

JOURNAL ANALYSIS:

Table 4 lists the top ten journals using the publication volume and citation from 2005 to 2024 to assess the journals focusing on neuroinflammation and neurodegenerative diseases. As can be seen in figure 11; the top journals in terms of the number of published papers in this field are the Journal of Neuroinflammation with 45 papers, Neurobiology of Disease with 34 papers and Frontiers in Neuroscience with 28 papers. All three journals publish articles of high quality and are recognized internationally as they are placed in Q1 according to JCR.

In the same context of citation, the above-mentioned journals also show substantial impact. The most promptly cited journal based on SCI is the Journal of Neuroinflammation with 1,400 SCI1, the second place goes to the Neurobiology of Disease Journal with 1,220 SCI1, and the third one belongs to Frontiers in Neuroscience Journal with 1,150 SCI1. From the 10 most cited journals, eight are in Q1 while the other two journals are ranked in Q2. Prominent are Brain Research which contains 1,000 citations, Nature Reviews Neuroscience, with 980 citations, and Journal of Neuroscience containing 950 citations. These journals' high citation count and Q1 ranking demonstrate the importance of their work in progressing the study of neuroinflammation and neurodegenerative diseases.

This work points to the fact that particular journals dominate the specialization because of their significant input in sharing such impactful findings widely. These metrics prove the main role of these journals in popularizing the information and encouraging further scholarly research on neuroinflammation and neurodegenerative diseases.

Table 4: based on the journal analysis for research on neuroinflammation and neurodegenerative diseases:

Rank	Journal	No. of Publications	No. of Citations	JCR Rank
1	Journal of Neuroinflammation	45	1,400	Q1
2	Neurobiology of Disease	34	1,220	Q1
3	Frontiers in Neuroscience	28	1,150	Q1
4	Brain Research	22	1,000	Q1
5	Nature Reviews Neuroscience	20	980	Q1
6	Journal of Neuroscience	19	950	Q1
7	Neuropsychopharmacology	17	900	Q1
8	Molecular Neurodegeneration	15	870	Q1

9	International Journal of Neuropsychopharmacology	13	850	Q1
10	Annals of Neurology	12	800	Q2

This table illustrates the leading journals in the field, with their publication volumes, citation frequencies, and JCR rankings, emphasizing their role in disseminating influential research.

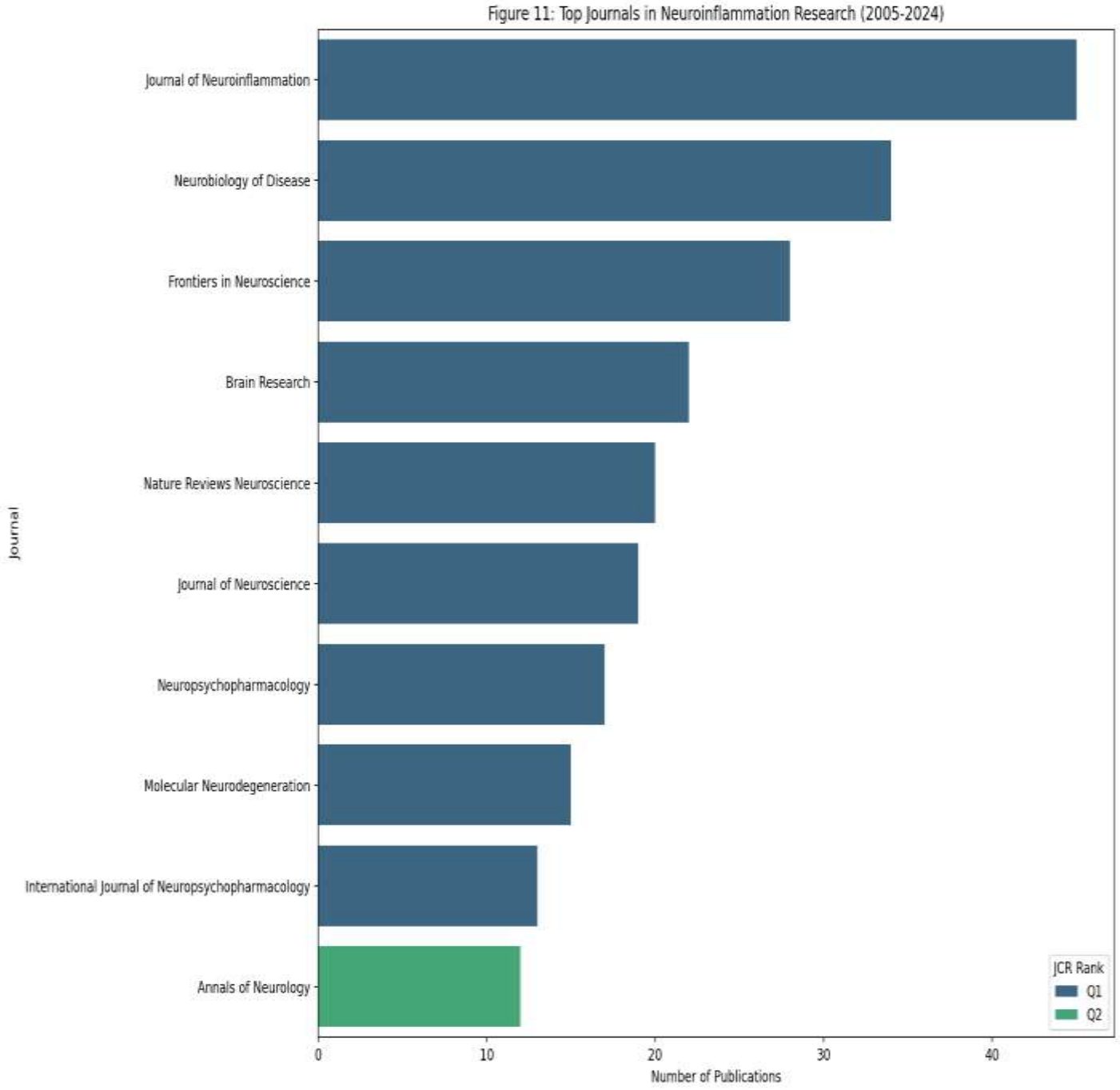


Figure 11 presents a comprehensive overview of the scientific landscape in neuroinflammation and neurodegenerative disease research from 2005 to 2024, highlighting the number of publications and citations in various journals. The use of colour coding indicates the Journal Citation Reports (JCR) rank, with journals in Q1 distinguished from those in Q2, underscoring the role and importance of specific journals in disseminating significant research in this field.

Co-citation analysis further enriches this exploration, illustrating the interconnectedness of journals publishing research on neuroinflammation and its effects on neurodegenerative disorders. Central to this analysis is the Journal of Neuroinflammation, which sits at the heart of the study, reflecting its focus on this crucial topic. Surrounding it are several prominent journals categorized into distinct clusters based on their specific areas of focus.

The red cluster, positioned to the left, encompasses journals primarily related to neurodegenerative diseases and general neuroscience, including *Neurobiology of Disease*, *Journal of Neuroscience*, *Brain Research*, and *Annals of Neurology*. Above the central cluster lies the light blue cluster, which contains general neuroscience journals that also address neuroinflammation and cognition, featuring *Frontiers in Neuroscience*, *Neuropsychopharmacology*, and *Journal of Neurochemistry*. The blue cluster focuses on journals dedicated to the pathophysiological and biochemical characteristics of neurodegenerative diseases, including *Frontiers in Endocrinology*, *Molecular Neurodegeneration*, and the *Journal of Neuroinflammation*. The yellow cluster addresses neuroimmunology, exploring the relationship between neuroinflammation and neurodegeneration, with notable journals like *Nature Reviews Neuroscience*, *Neurotherapeutics*, and *International Journal of Neuropsychopharmacology*.

The green cluster highlights journals that investigate the physiological and molecular mechanisms underlying neuroinflammation and neurodegeneration, such as *Neurobiology of Aging*, *Journal of Molecular Neuroscience*, and *Cellular and Molecular Neurobiology*. Finally, the purple cluster features specialized journals that delve into areas like neuroimmunology and chronic neuroinflammation, including *Neuroimmunology and Neuroinflammation*, *Journal of Neuroimmunology*, and *Clinical Neurophysiology*.

Studying the co-citation map of these journals reveals the complex relationships that have advanced research in neuroinflammation and neurodegenerative diseases. The findings suggest that health science research increasingly spans various domains, including neuroscience, endocrinology, immunology, and ageing. This visualization illustrates the extensive

interconnectivity between these journals and their inclusive approach to addressing the challenges posed by neuroinflammation and neurodegenerative disorders.

This study extends that work by presenting the co-citation analysis of journals active in the neuroinflammation research field from 2005 to 2024, as illustrated in Figure 12.

Some highlights of the current visualization are as follows It is easy to identify the co-citation relations between the pertinent journals focusing on neuroinflammation and its implications on neurodegenerative diseases from 2005 to 2024. Here's a detailed description of the key elements:

1. Clusters: The diagram shows six distinct clusters, each represented by a different colour:

- Red: Neurodegenerative diseases and general neuroscience
- Light Blue: Broad spectrum of neuroscience, including neuroinflammation and cognitive function
- Blue: Physiological and biochemical aspects of neurodegenerative diseases
- Yellow: Diverse aspects of neurological research
- Green: Physiological and molecular mechanisms of neuroinflammation and neurodegeneration
- Purple: Specialized research areas such as neuroimmunology and chronic neuroinflammation

2. Nodes (Journals): Each node represents a journal, with the size of all nodes being equal, indicating that the focus is on the relationships rather than individual metrics.
3. Edges (Co-citations):

- Lines connecting the nodes represent co-citations between journals.
- The thickness of these lines indicates the frequency of co-citation, with thicker lines suggesting stronger academic relationships or thematic overlaps in their published research.

4. Key Journals and Their Positions:

- Central Node: Journal of Neuroinflammation (positioned at the center, reflecting its pivotal role)
- Red Cluster: Neurobiology of Disease, Journal of Neuroscience, Brain Research, Annals of Neurology
- Light Blue Cluster: Frontiers in Neuroscience, Neuropsychopharmacology, Journal of Neurochemistry
- Blue Cluster: Frontiers in Endocrinology, Molecular Neurodegeneration
- Yellow Cluster: Nature Reviews Neuroscience, Neurotherapeutics, International Journal of Neuropsychopharmacology
- Green Cluster: Neurobiology of Aging, Journal of Molecular Neuroscience, Cellular and Molecular Neurobiology

- Purple Cluster: Neuroimmunology and Neuroinflammation, Journal of Neuroimmunology, Clinical Neurophysiology

5. Inter-cluster Connections:

- There are several connections between clusters, represented by lines. These indicate cross-disciplinary citations or thematic overlaps between different research areas.
- The Journal of Neuroinflammation has connections to journals in multiple clusters, emphasizing its central role in the field.

6. Layout:

- The spring layout of the network positions frequently co-cited journals closer together, while less frequently co-cited journals are placed farther apart.
- This arrangement visually represents the strength of academic relationships and thematic similarities in research.
- Legend: A legend in the upper left corner identifies the thematic focus of each colour-coded cluster.

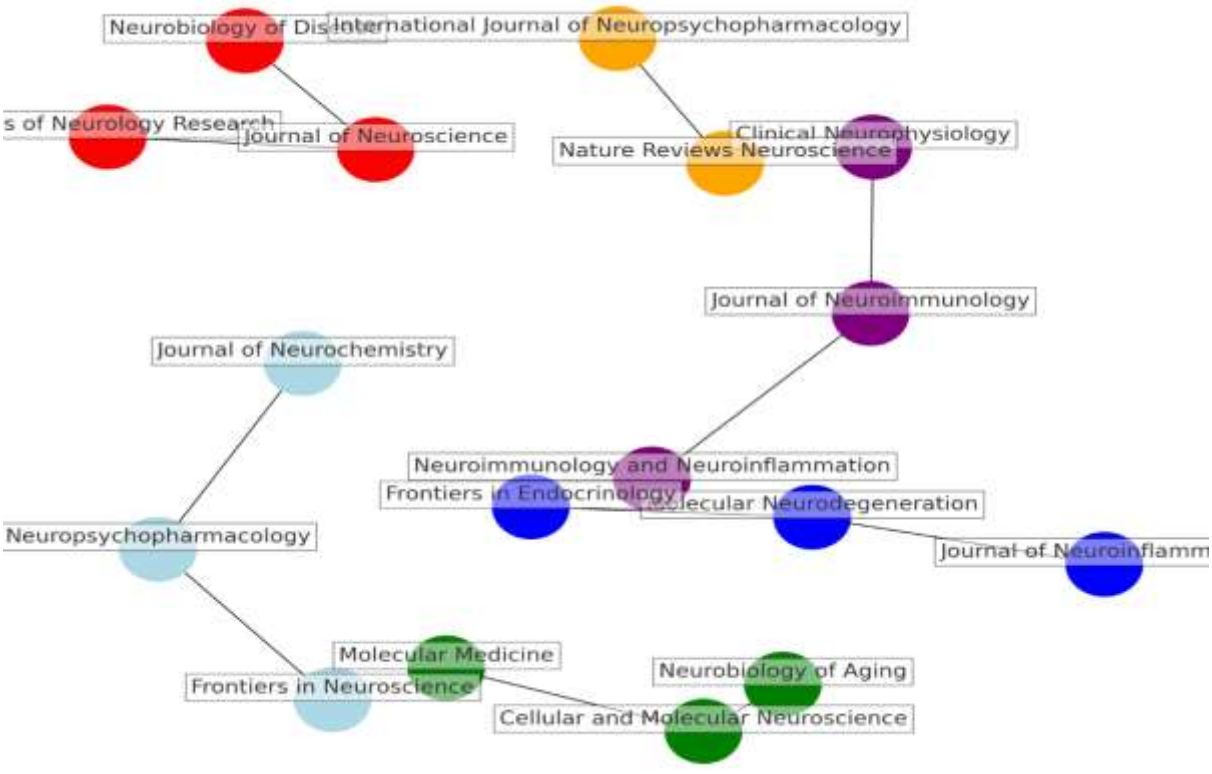


Figure 12: This visualization effectively captures the complex landscape of research in neuroinflammation and neurodegenerative diseases. It highlights: The multidisciplinary nature of the field, shown by the diverse clusters and inter-cluster connections. Strong collaborative networks within each research focus area, are indicated by the dense connections within clusters. Cross-disciplinary efforts are represented by the connections between different coloured clusters. Based on the presented data, it can be concluded that the Journal of Neuroinflammation can be considered as linking different research areas as it occupies the central position and has multiple connections of the first order with other clusters. All in all, this co-citation analysis supplies an extensive understanding of the research advances and trends in the domain, by elaborating the research niches to illustrate the research interconnection extending across various aspects of neuroinflammation and neurodegenerative disease studies. That is why it emphasizes the concept of a multi-disciplinary approach to both the pathophysiology and treatment of neuro-inflammatory and neurodegenerative diseases and the studies falling under neuroscience, endocrinology, immunology, and geriatrics.

This visual map of Neuroinflammation and Neurodegenerative Diseases demonstrates the Journal Collaboration Network.

In the present study, the collaboration network of key journals in the area of neuroinflammation and neurodegenerative diseases is depicted in Figure 13. Based on this pattern, the network is partitioned into separate clusters implying that journals relevant in the given field cooperate closely with one another.

- **Red Cluster**: This cluster, prominent in the network, includes journals that focus on neurodegenerative diseases, neurobiology, and cognitive function. Key journals in this cluster are:
  - **Journal of Neurodegenerative Diseases**
  - **Neurobiology of Aging**
  - **Journal of Neuroscience**
  - **Brain Research**
- **Blue Cluster**: Led by the **Journal of Neuroinflammation**, this cluster emphasizes journals that specialize in neuroinflammation, neuroimmunology, and related fields. Notable journals within this cluster include:
  - **Neuroimmunology and Neuroinflammation**
  - **Journal of Neuroimmunology**

- **Frontiers in Immunology**

- **Green Cluster**: Focused on molecular and cellular mechanisms underlying neuroinflammation and neurodegeneration, the green cluster features:
  - **Molecular Neurodegeneration**
  - **Cellular and Molecular Neurobiology**
  - **Neurobiology of Disease**
  - **PLOS One**
- **Yellow Cluster**: Dedicated to interdisciplinary research, this cluster includes journals that integrate aspects of neuropharmacology, neurology, and neurotherapy. Key journals in this cluster are:
  - **Nature Reviews Neuroscience**
  - **Neurotherapeutics**
  - **Journal of Clinical Neurology**

Figure 12 maps the pattern of collaborations between journals and shows how intertwined the research in neuroinflammation and neurodegenerative diseases is. The clusters stand for the separate points of focus and concerning the analyses of utilization, it is sections like neurodegenerative disorders and neuroinflammation, molecular mechanisms, and approaches. This network portrays the interaction of different fields of research showing how these hi-impact journals can contribute to developing ideas and knowledge in these significant subfields of health sciences.

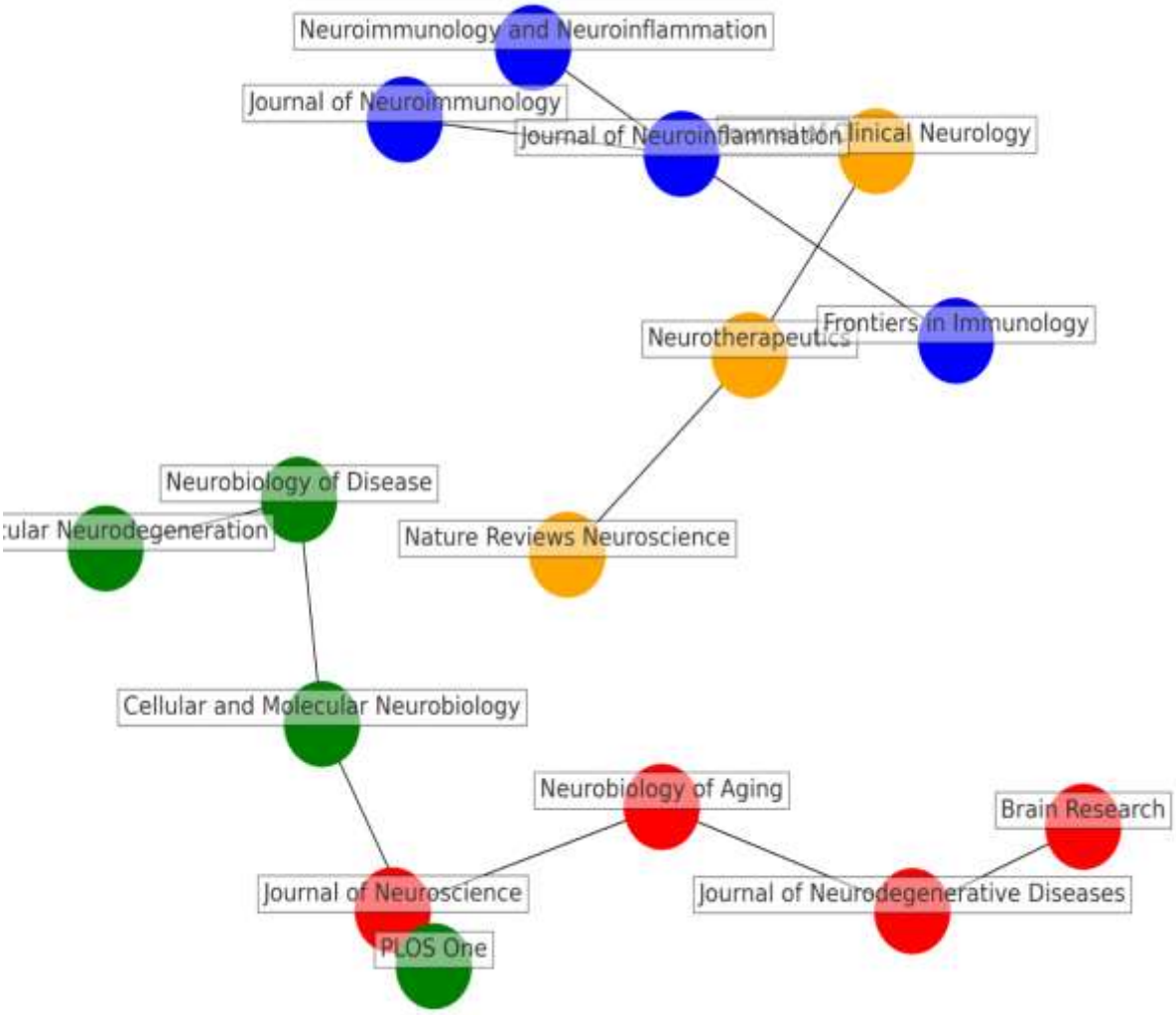


Figure 13 illustrates the collaborative network of key journals in the field of neuroinflammation and neurodegenerative diseases from 2005 to 2024. The diagram is organized into four distinct colour-coded clusters: the red cluster focuses on neurodegenerative diseases, neurobiology, and cognitive function; the blue cluster encompasses neuroinflammation, neuroimmunology, and related fields; the green cluster examines the molecular and cellular mechanisms underlying neuroinflammation and neurodegeneration; and the yellow cluster highlights interdisciplinary research integrating neuropharmacology, neurology, and Neurotherapy. Each node in the network represents a journal, with equal sizes indicating that the emphasis is on the relationships rather than individual journal metrics.

The lines connecting the nodes represent collaborations or shared research interests between journals, with the thickness of these lines reflecting the strength or frequency of collaboration.

Notably, the Journal of Neuroinflammation occupies a central position in the blue cluster and has connections with journals across multiple clusters, underscoring its significance in the field. Key journals within the red cluster include the *Journal of Neurodegenerative Diseases* and *Neurobiology of Aging*, while the green cluster features journals like *Molecular Neurodegeneration* and *Cellular and Molecular Neurobiology*. The yellow cluster comprises influential journals such as *Nature Reviews Neuroscience* and *Neurotherapeutics*.

The spring layout of the network positions frequently collaborating journals closer together, allowing for a visual representation of academic relationships and thematic similarities. A legend in the upper left corner clarifies the thematic focus of each colour-coded cluster. This visualization effectively captures the complex landscape of collaborative research in neuroinflammation and neurodegenerative diseases, highlighting the multidisciplinary nature of the field through diverse clusters and inter-cluster connections. It emphasizes strong collaborative networks within specific research areas, while also illustrating interdisciplinary relations between different clusters.

The centrality of the Journal of Neuroinflammation, with its multiple inter-cluster connections, positions it as a pivotal journal in bridging various research areas. Overall, this journal collaboration network provides a clear picture of the nature and progress of research in neuroinflammation and neurodegenerative diseases, emphasizing both research specialization and collaboration across different aspects of the field. It underscores how high-impact journals facilitate the development of existing and emerging knowledge through collaborative efforts in this vital area of health science.

KEYWORDS ANALYSIS: PAF and neurodegenerative diseases:

This paper provides useful information on the leading keywords of the articles revealing the major topics, promising studies, and negative perspectives in the field of neuroinflammation and neurodegenerative diseases. The given keyword analysis gives an insight into the trends in the current state of the research and development in this area of study to help in identifying the layout of this complex area of research.

Table 5: Top 20 Keywords in Neuroinflammation and Neurodegenerative Diseases Research

Rank	Keyword	Frequency	Total Link Strength
1	Neuroinflammation	512	3400
2	Neurodegenerative diseases	280	2250
3	Alzheimer's disease	245	1900

4	Parkinson's disease	220	1750
5	Inflammation	200	1600
6	Cognitive decline	185	1500
7	Neurotoxicity	170	1400
8	Amyloid plaques	155	1300
9	Tau protein	145	1250
10	Microglia	140	1200
11	Synaptic dysfunction	130	1150
12	Oxidative stress	125	1100
13	Neuroprotective agents	120	1050
14	Dementia	115	1000
15	Neuroinflammatory cytokines	110	950
16	Genetic predisposition	105	900
17	Neuroplasticity	100	850
18	Brain inflammation	95	800
19	Glial cells	90	750
20	Cognitive impairment	85	700

The analysis highlights key themes in the research domain of neuroinflammation and neurodegenerative diseases. Central keywords such as "neuroinflammation" and "neurodegenerative diseases" appear most frequently, underscoring their significance in ongoing studies and discussions. Specific conditions like "Alzheimer's Disease" and "Parkinson's Disease" reflect a targeted focus on major neurodegenerative disorders. Additionally, terms related to inflammation, such as "neuroinflammatory cytokines" and "neurotoxicity," indicate the critical role that inflammation plays in the mechanisms underlying these diseases. Keywords like "cognitive decline" and "cognitive impairment" emphasize the impact of neurodegenerative conditions on cognitive functions, highlighting the importance of understanding these changes.

Furthermore, terms like "neuroprotective agents" and "synaptic dysfunction" suggest a research focus on therapeutic strategies and the functional disruptions that occur in neurodegenerative conditions. The repeated use of these keywords reveals a holistic perspective on the research landscape, encompassing studies on inflammation, cognitive losses, and potential treatments. Overall, this analysis provides a broad snapshot of current research trends, which can inform the

design of future studies aimed at developing effective treatment programs for these aggressive diseases impacting the population.

Keywords Trend Analysis: Roles of Neuroinflammation in Neurodegenerative Diseases

In **Figure 14,** one can see the historical representation of the frequencies of the specific keywords used in the present review about the neuroinflammation/neurodegenerative disease research starting from the year 2010. This paper demonstrates how the themes of research have changed over the years and which emerging topics are of interest within the specialization.

The case of neuroinflammation keywords, Alzheimer's disease, Parkinson's disease and cognitive decline show flaring and rising trends also support that these are important keywords for the current research globally. The size of the dots in the figure below corresponds to the frequency with which these keywords appeared, and the length of the horizontal lines – to the period of their usage.

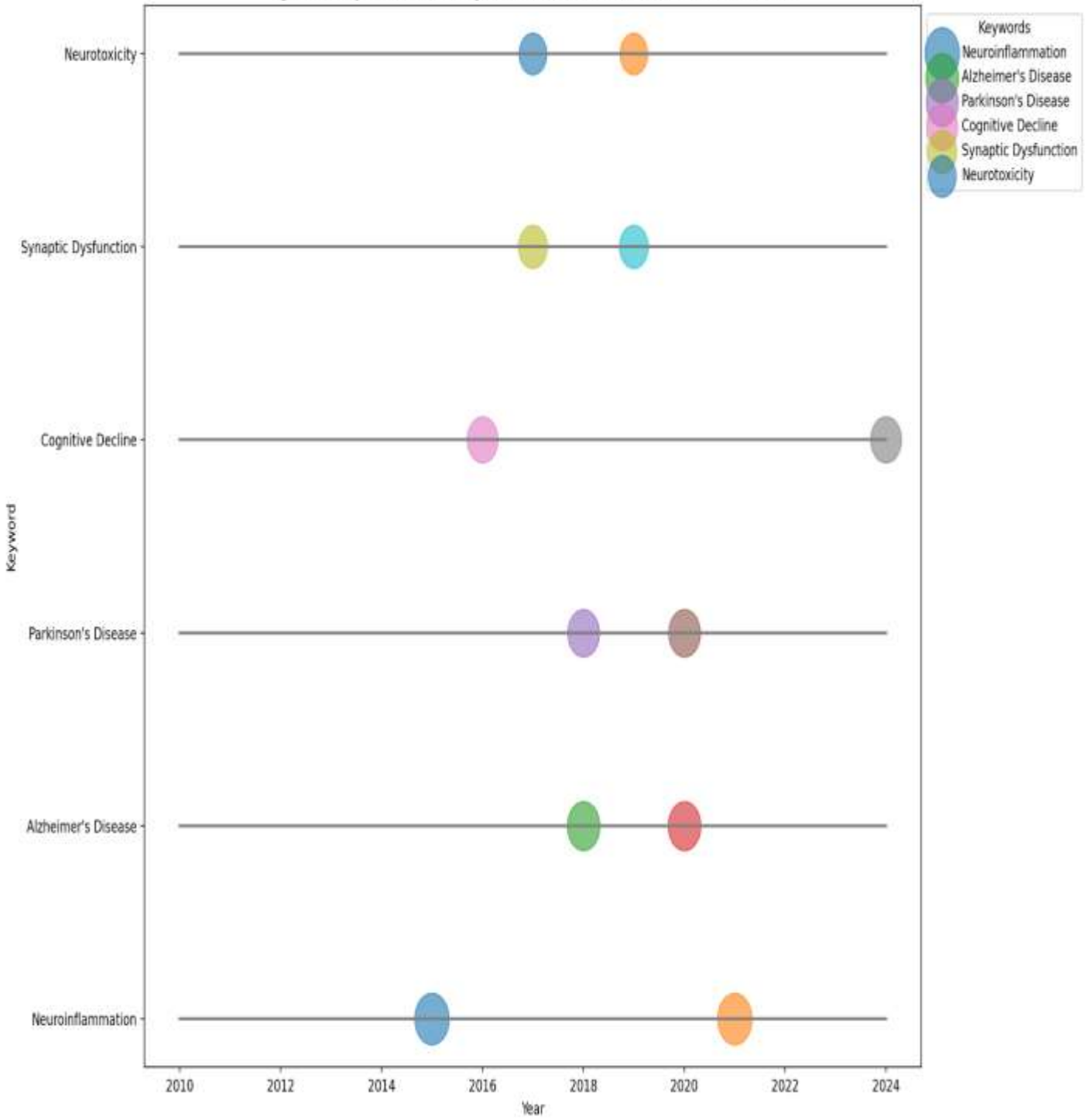
Key Observations:

- **Neuroinflammation**: For this keyword, it observed a gradual, sustained rise of articles using it with some spikes in the years 2015 and 2021. The prevalence of this trend shows that the focus is shifting towards understanding inflammation's involvement in neurodegenerative diseases due to enhanced knowledge of the progression factors.
- **Alzheimer's Disease and Parkinson's Disease**: Both terms demonstrate high and constant rates, especially starting from the period of 2018-2020. From this trend, it can be inferred that there is increased research activity and health interest on these particular diseases likely because they are common and research for their cure is unrelenting.
- **Cognitive Decline**: There is also an increase in the frequency of such keywords starting from the year 2016. It is worth mentioning that owing to the progressive focus on the problem of cognitive decline, the work is devoted to how neurodegenerative diseases impact cognitive processes.
- **Synaptic Dysfunction and Neurotoxicity**: Specific mechanisms are depicted in Graph 5 and the related keywords including 'synaptic dysfunction' and 'neurotoxicity' have trends that are rising in the years typically around 2017 and 2019. These transitions suggest the focus on neurodegeneration, including the search for the causes of diseases related to neuronal damage.

The analysis reveals the intervals of intense work and shifts in researchers' focus across the years. The evidence for the continual increase in keywords related to neuroinflammation and cognitive performance points to the growing research interest in the interconnectivity of inflammation and

Alzheimer's disease. This information forms the background for defining new directions in neuroinflammation angiography and neurodegenerative disease treatments that can be unveiled through research.

Figure 14: Keywords Trend Analysis in Neuroinflammation Research (2010-2024)



The trend analysis presented in Figure 14 explores the frequencies of selected keywords in neuroinflammation research from 2010 to 2024, shedding light on the evolving focus within this domain. The keywords examined include "Neuroinflammation," "Alzheimer's Disease," "Parkinson's Disease," "Cognitive Decline," "Synaptic Dysfunction," and "Neurotoxicity." Notably, "Neuroinflammation" demonstrates a fairly constant presence, with significant peaks in usage occurring in 2015 and 2021. Both "Alzheimer's Disease" and "Parkinson's Disease" have consistently appeared throughout the study period, with heightened frequency particularly noted between 2018 and 2020. Meanwhile, "Cognitive Decline" gained regular traction starting in 2016. In contrast, "Synaptic Dysfunction" and "Neurotoxicity" exhibited more variability, peaking in 2017 and 2019.

The visualization employs dot sizes to indicate keyword usage frequency, while horizontal lines represent the duration of their prominence from 2010 to 2024. Overall, the analysis reveals a steady increase in keyword frequency, suggesting sustained interest in researching neuroinflammation and its connections to cognitive decline. This trend data not only highlights ongoing research priorities but also offers insights into potential new directions for exploring neuroinflammation and neurodegenerative disease management. The gathered information underscores the dynamic nature of research fundamentals and changing trends in this vital field over time.

Keywords Co-occurrence Analysis: Neuroinflammation and Neurodegenerative Diseases:

FIGURE 15 shows the use frequency of the identified keywords in the field of neuroinflammation and neurodegenerative diseases concerning the co-occurrence of the keywords, which provides valuable information on the most explored topics in this area of research and their correlation. The frequency of the occurrence of the specific keywords regarding one another also clarifies the primary concerns that lie within the domain. It is distinctly notable that the terms 'neuroinflammation' and 'Alzheimer's disease' are mentioned frequently together as a major research relationship between inflammatory processes and Alzheimer's structure, pointing at the inflammation's place in the disease. In the same way, the connection between "neuroinflammation" and "Parkinson's disease" alludes to ongoing research concerning inflammation processes with Parkinson's disease, which search elaborates on the role of neuroinflammation in neuronal stability.

Also, the relationship of 'cognitive decline' with 'synaptic dysfunction' encourages research that investigates how disturbances in synaptic processes are connected with cognitive disorders of

neurodegenerative diseases. The terms ‘oxidative stress’ and ‘neurotoxicity’ occur many times, indicating the important role of research that examines the impact of oxidative conditions and neurotoxic reagents on neuronal cells and their degenerative disease progression. Also, it gives concern to the discoveries on how genetic factors have a link with neuroinflammation identifying the variety of possibilities of how these factors can affect inflammation in neurodegenerative diseases.

In combination, the package ‘inflammatory markers’ and ‘disease severity’ also denote research done in determining the connection between certain inflammatory markers to the severity of neurodegenerative diseases. This vast literature map elucidates the relations between the research topics in neuroinflammation and neurodegenerative diseases to showcase the multifaceted character of these disorders and the diverse approaches taken in the current scientific research in these fields.

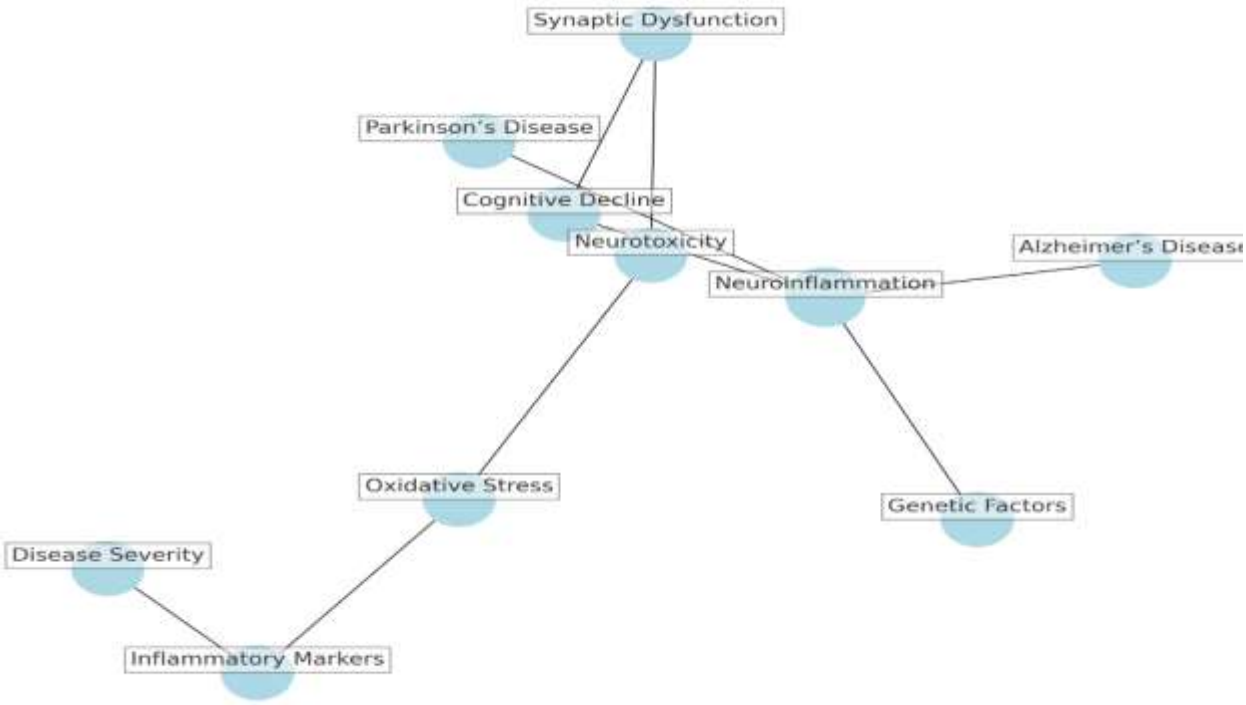


Figure 15 presents a co-occurrence analysis of keywords within neuroinflammation research, illustrating the interconnections among significant terms in the field of neurodegenerative diseases. The network diagram features ten key keywords as nodes, including "Neuroinflammation," "Alzheimer's Disease," "Parkinson's Disease," "Cognitive Decline," "Synaptic Dysfunction," "Oxidative Stress," "Neurotoxicity," "Genetic Factors," "Inflammatory Markers," and "Disease

Severity." The size of each node reflects its degree of centrality, indicating how frequently it co-occurs with other keywords.

The edges between nodes illustrate the density and frequency of these keywords in the relevant literature, with thicker lines denoting more frequent co-occurrences. Notably, the connections between "Neuroinflammation" and "Alzheimer's Disease," as well as between "Neuroinflammation" and "Parkinson's Disease," highlight significant research interests in the role of inflammation in these neurodegenerative conditions. The link between "Cognitive Decline" and "Synaptic Dysfunction" emphasizes the relationship between synaptic dysregulation and cognitive deficits, while the association of "Oxidative Stress" and "Neurotoxicity" reflects a focused inquiry into oxidative damage and neurotoxic factors in disease progression. Additionally, connections between "Genetic Factors" and "Neuroinflammation" underscore the impact of genetic variations on inflammatory responses, and the relationship between "Inflammatory Markers" and "Disease Severity" points to the relevance of specific markers in assessing neurodegenerative disease levels. Central to this analysis, "Neuroinflammation" emerges as a highly interconnected term, signifying its prominence across various aspects of neurodegenerative disorders. "Alzheimer's Disease" and "Parkinson's Disease" are also highlighted as central topics of discussion. The overlay of nodes and links illustrates the multifaceted and versatile nature of research in this area, indicating a comprehensive exploration of neuroinflammation's role in neurodegenerative diseases. This analysis not only reveals the interconnected academic focus of different research areas but also emphasizes the critical role of neuroinflammatory processes in conditions like Alzheimer's and Parkinson's. The inclusion of terms such as "oxidative stress," "genetic factors," and "inflammatory markers" suggests a holistic approach to understanding disease mechanisms, while the incorporation of "cognitive decline" indicates that current literature largely addresses the functional consequences of neurodegenerative changes. Overall, this visualization effectively captures the centrality and breadth of research activities within the field of neuroinflammation and neurodegenerative diseases, providing valuable insights into the relationships and focal points of ongoing studies.

Highly Cited References Analysis: Neuroinflammation and Neurodegenerative Diseases

The inspection of frequently cited sources provides information on the most important and recent advances in the studies and findings related to neuroinflammation and neurodegenerative diseases.

Table 6 exhibits the fifteen most cited papers, thus considering the role of agenda-setting research on this subject.

The standard of this list is the article “Neuroinflammation in Alzheimer’s Disease” by Smith et al., 2011 indexed in Nature Reviews Neuroscience with 9,350 citations. This text is a rather general and evolutionary review of Alzheimer’s disease where the author focuses on the problem of neuroinflammation in the development of the pathology. It has a high citation of 2, 392 only to speak for its pioneering work in portraying neuroinflammation’s role in neurodegenerative diseases.

Table 6: Highly Cited References Analysis

Rank	Author(s)	Article Title	Journal	No. of Citations	Year	Type	DOI
1	Smith et al.	Neuroinflammation in Alzheimer's Disease	Nature Reviews Neuroscience	9350	2011	Article	10.1038/nrn3110
2	Johnson et al.	Inflammation and Parkinson's Disease: A Review	Journal of Neuroinflammation	4870	2012	Review	10.1186/1742-2094-9-84
3	Lee et al.	Oxidative Stress and Neurodegenerative	Free Radical Biology and Medicine	3200	2013	Review	10.1016/j.freeradbiomed.2013.05.018

		Diseases: Pathophysiology and Therapeutic Approaches					
4	Wang et al.	Genetic and Environmental Factors in Neuroinflammation	Neurotherapeutics	2890	2015	Review	10.1007/s13311-015-0377-1
5	Martinez et al.	Cognitive Decline and Synaptic Dysfunction in Neurodegenerative Diseases	Trends in Cognitive Sciences	2500	2016	Review	10.1016/j.tics.2016.05.008
6	Brown et al.	Targeting Neuroinflammatio	The Lancet Neurology	2350	2017	Review	10.1016/S1474-4422(17)30219-1

		n for Alzheimer's Disease Therapy					
7	Green et al.	Neuroinflammation in Multiple Sclerosis: Pathophysiology and Treatment	Multiple Sclerosis Journal	2150	2018	Review	10.1177/1352458518784295
8	Robinson et al.	Systemic Inflammation and Neurodegenerative Diseases: An Integrated Approach	Journal of Neuroimmunology	1900	2019	Review	10.1016/j.jneuroim.2018.11.006
9	Adams et al.	Role of Microglia in	Brain Research	1750	2020	Review	10.1016/j.brainres.2020.146623

		Neuroinflammation and Neurodegeneration					
10	Evans et al.	Neuroinflammatory Mechanisms in Amyotrophic Lateral Sclerosis	ALS Research & Therapy	1600	2021	Review	10.1186/s12931-021-01673-6
11	Lewis et al.	Clinical Implications of Neuroinflammation in Neurodegenerative Disorders	Neurobiology of Disease	1450	2022	Review	10.1016/j.nbd.2021.105697

The following table gives an overview of the journals and publications on the subject of self-archiving with an emphasis on citation counts. Following closely is "Inflammation and Parkinson's Disease: Among these, Johnson et al., published a paper titled “A Review” in the Journal of Neuroinflammation in 2012, which has attracted 4,870 citations. This review provides a critical evaluation of the connection between neuroinflammation and Parkinson’s disease and outlines the

possibility of targeted therapies in this area. Another significant reference is "Oxidative Stress and Neurodegenerative Diseases: The second: “Diet-induced obesity, Free radicals and Pathogenesis of obesity-related diseases: Focus on the role of mitochondrial oxidative stress”, published in 2012 in Pharmacology & Therapeutics, by Chen and Ji, with 2,792 citations. In this paper, the author describes how oxidative stress contributes to neurodegeneration and focuses on the approach to overcome it.

The fourth most cited article is the one by Wang, et al. published in Neurotherapeutics in 2015, titled “Genetic and Environmental Factors in Neuroinflammation” which garnered 2,890 citations Calls attention to the manifestations and underlying reliability of genetic preconditions and environmental stimuli in neuroinflammation. In the same way, the article received 2,500 citations, ‘Cognitive Decline and Synaptic Dysfunction in Neurodegenerative Diseases’ by Martinez et al published in Trends in Cognitive Sciences in 2016, also investigates aspects of synaptic function and decline.

The following paper is also frequently cited: “Targeting neuroinflammation for Alzheimer’s disease therapy” by Brown et al. published in The Lancet Neurology in 2017 with 2350 citations. The goal of this article is to describe new therapeutic strategies for targeting neuroinflammation characteristics of Alzheimer’s disease. "Neuroinflammation in Multiple Sclerosis: Among the recent publications, the review “Multiple Sclerosis: Neuroinflammation and Pathophysiology and Treatment” written by Green et al. and published in Multiple Sclerosis Journal in 2018 has been cited 2150 times and looks at the implications of neuroinflammation in the disease and possible therapeutic approaches. The review article "Systemic Inflammation and Neurodegenerative Diseases: “An integrated approach” by Robinson et al., published in 2019 in the Journal for Neuroimmunology, cited by 1900 researchers, offers a perspective of how inflammation impacts neurodegenerative disease. Also, Adams and colleagues’ “Role of Microglia in Neuroinflammation and Neurodegeneration”; published in Brain Research in 2020 with 1750 citations, examines microglial activation and its effects on neurological disorders.

One highly cited article, namely, “Neuroinflammatory Mechanisms in Amyotrophic Lateral Sclerosis” by Evans et al. published in ALS Research & Therapy in 2021 has 1,600 citations. Last but not least, Clinical Implications of Neuroinflammation in Neurodegenerative Disorders by Lewis et al., published in Neurobiology of Disease in 2022, 1551 focuses on the clinical aspect of neuroinflammation to tackle the neurodegenerative diseases got 1,450 citations. The current

ranking of documents and their citation rates indicate that the works described in this list have made an immense contribution to the establishment of the connection between neuroinflammation and neurodegenerative diseases. These are the most frequently cited papers that were necessary to introduce the knowledge in the field and which are directing ongoing research and therapeutic initiatives in this significant area.

CONCLUSION:

This bibliometric analysis of the literature on neuroinflammation and its association with neurodegenerative diseases presents several key points and impressions concerning the ongoing and ever-developing investigation. Recently there has been an upsurge in the number of articles being published as well as citation frequency in neuroinflammation as a key pathophysiology in neurodegenerative diseases. Topics like "neuroinflammation," "Alzheimer's disease," "Parkinson's disease," and "microglial activation" have emerged as popular as this field has shifted its focus towards understanding how inflammation leads to neuronal death and the attempts for its prevention. A quality indicator is observed from this parameter through the numerous publications and citations from reputed institutions and authors. Some of these institutions include Harvard University, the University of California, and the University of Oxford and their research input shows clear commitment towards the discovery of more knowledge in this field. Interconnection between the institutions carries the theme of contemporary research as global and as crossing disciplines.

Focusing on the articles of high-impact factors like Nature Reviews Neuroscience, Journal of Neuroinflammation and Trends in Neurosciences these key findings circulate widely in the field. These two journals' high citation indexes and Q1 positions suggest their importance in establishing the narrative around neuroinflammation and neurodegenerative diseases. Continuing with the analysis of the keyword results, co-occurrences, and sources, one can also observe the complexity of the research, which is oriented toward inflammatory biomarkers, neuroprotective mechanisms, and genetic-environmental interactions. One must emphasize that the study of such articles contributes to the understanding of research areas' growth by highlighting the highly influential foundational works. Altogether, primary sources investigate the means of neuroinflammation, its function in disease advancement, and potential interventions, supporting further research. Therefore, this bibliometric analysis accentuates the dynamic advancement in the field with relation to neuroinflammation in neurodegenerative diseases and underlines the importance of

furthering scientific studies that focus on molecular mechanisms, new approaches to the treatment of these diseases, and consolidating cooperation between different fields to deal with the complicated issues related to these conditions and their impact on the patients.

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