

# The Evolution of Hypothalamus Publications with Bibliometric Analysis During 1980-2020

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## Abstract

**Objective:** The hypothalamus, which is the main control center of the autonomic nervous system has been the subject of many studies around the world with increasing interest. The aim of this study was to make a comprehensive and holistic analysis of the publications on the hypothalamus between 1980 and 2020 with bibliometric approaches.

**Methods:** The Web of Science database was used to identify publications on the hypothalamus between 1980 and 2020. The identified publications were then analyzed using bibliometric approaches.

**Results:** As a result of the literature review, a total of 35919 publications were found. The three most active countries in the production of articles on the subject of the hypothalamus were the USA (n=9685), Japan (2636), and the UK (2065). A statistically significant positive correlation was found between the number of articles produced by countries on the hypothalamus and Gross Domestic Product (GDP) and GDP per capita development indicators ( $r=0.785$ ,  $p<0.001$ ;  $r=0.511$ ,  $p<0.001$ , respectively).

**Conclusion:** Recent studies on the hypothalamus have focused on the functional connection of the hypothalamus with obesity, stress, and food intake. The findings of this study can be considered to be a comprehensive and useful guide for researchers interested in the topic of the hypothalamus.

**Key words:** Bibliometric analysis, Hypothalamus, Neuroendocrinology, Obesity, Food intake

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## INTRODUCTION

The hypothalamus is a brain structure that is developmentally and functionally linked to the pituitary, which regulates physiological homeostasis and basic behavioral orientations (1). The hypothalamus, located most ventrally in the forebrain, provides the secretion of endocrine hormones and the control of the autonomic nervous system (2,3). The hypothalamus plays a role in vital functions such as circadian rhythm, temperature regulation, and maintaining feeding habits (hunger/satiety) (4-7). The hypothalamus, which is the main control center of the autonomic nervous system provides corticotropin, vasopressin, and oxytocin release, psychological and behavioral regulation, control of circadian rhythm, regulation of body temperature, is the sex control centre, and regulates sweating, food intake, respiratory rate, blood pressure, and heart rate (8). Dysfunction of the hypothalamus has an important place in various health areas, including diabetes insipidus, sleep disorders, and energy imbalance (9-11). The hypothalamus has gained popularity as an important research issue in recent years because of its significant and varied roles in autonomic, homeostatic, and neuroendocrine activities, and has been the subject of many studies around the world with increasing interest.

Bibliometrics is an approach based on mathematical and statistical methods used in

the evaluation of various scientific publications such as articles, books, and reviews (12,13). It is a method that allows the identification of the most productive countries and institutions, the most effective authors, and the most qualified publications from a broad perspective by analyzing the publications on a particular field or subject from the past to the present. Bibliometry provides objective, detailed, and comprehensive information on the topic of interest for both researchers and institutions. In addition, the bibliometric analysis provides objective and reliable data about future studies for researchers interested in the subject by revealing past and current research trends related to the subject of interest.

The hypothalamus is a valuable subject of interest in many different disciplines, from anatomy to endocrinology. In the current literature, there is no bibliometric study that provides quantitative and qualitative analysis of scientific outputs related to the hypothalamus from the past to the present. The aim of this study was to conduct a comprehensive and holistic analysis of publications on the hypothalamus between 1980 and 2020 with bibliometric approaches and to identify the research issues and trends that have developed on the hypothalamus over 40 years.

## METHODS

In order to reach the articles published on the hypothalamus, the literature search in this study was performed using the keyword

hypothalamus\* (hypothalamus, hypothalamic, hypothalamotomy et al.) in the title of articles in the Web of Science (WoS) database (Search codes for repeatability; Title: (hypothalam\*) Refined by: Document Types: (Article) Timespan: 1980-2020. Indexes: SCI-Expanded, ESCI, SSCI, CPCI-S, BKCI-SSH, BKCI-S). As a result of this search method, all publications published on the hypothalamus in the WoS database were downloaded (accessed on 30.03.2021; the number of publications may vary according to the search data) and analyzed using bibliometric methods

### *Statistical analysis*

The website (<https://app.datawrapper.de>) was used for world map drawing. VOSviewer (Version 1.6.13) package program was used for bibliometric network visualizations (14). SPSS package (Version 22.0, SPSS Inc., Chicago, IL, USA, license: Hitit University) was used for statistical data analysis. Assessment of the normal distribution of the data was performed with the Kolmogorov-Smirnov test. Correlation analyses between the number of publications on the hypothalamus and the economic development indicators of countries according to Gross Domestic Product (GDP) per capita were investigated using the Spearman correlation coefficient in accordance with the data distribution (15). Linear regression analysis was used to estimate the number of publications to be made in the coming years. The  $R^2$  value in the regression analysis was

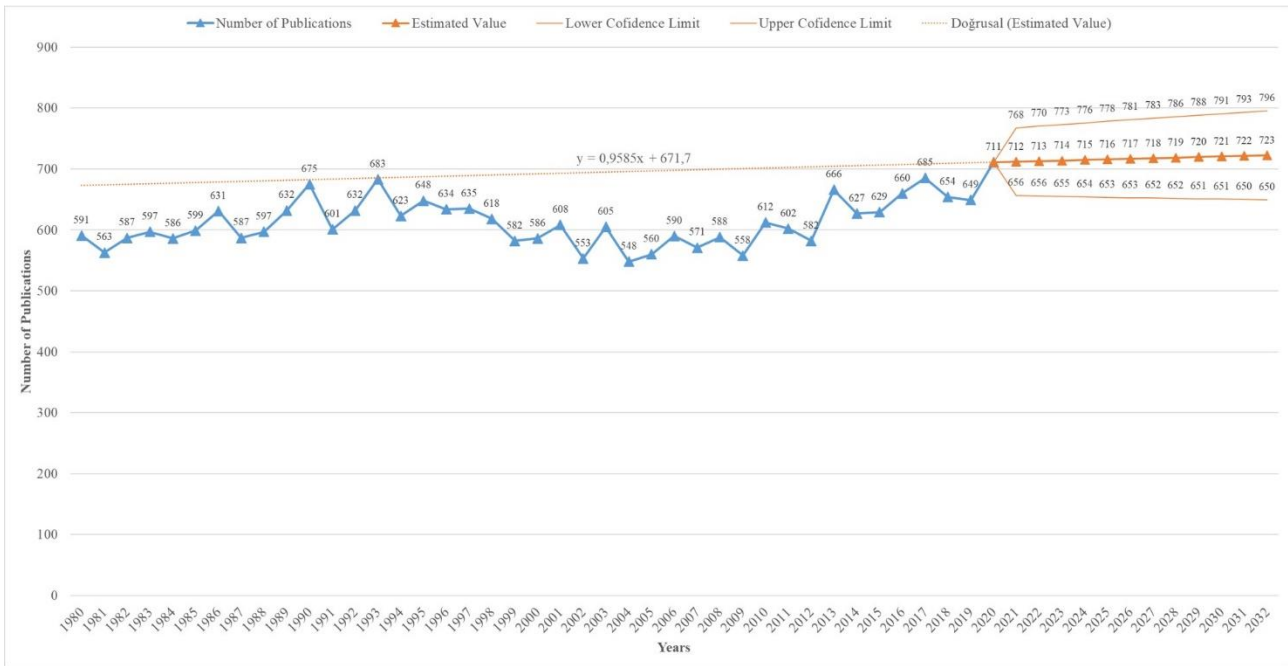
used to evaluate the model success. A value of  $p < 0.05$  was accepted as statistically significant.

### **RESULTS**

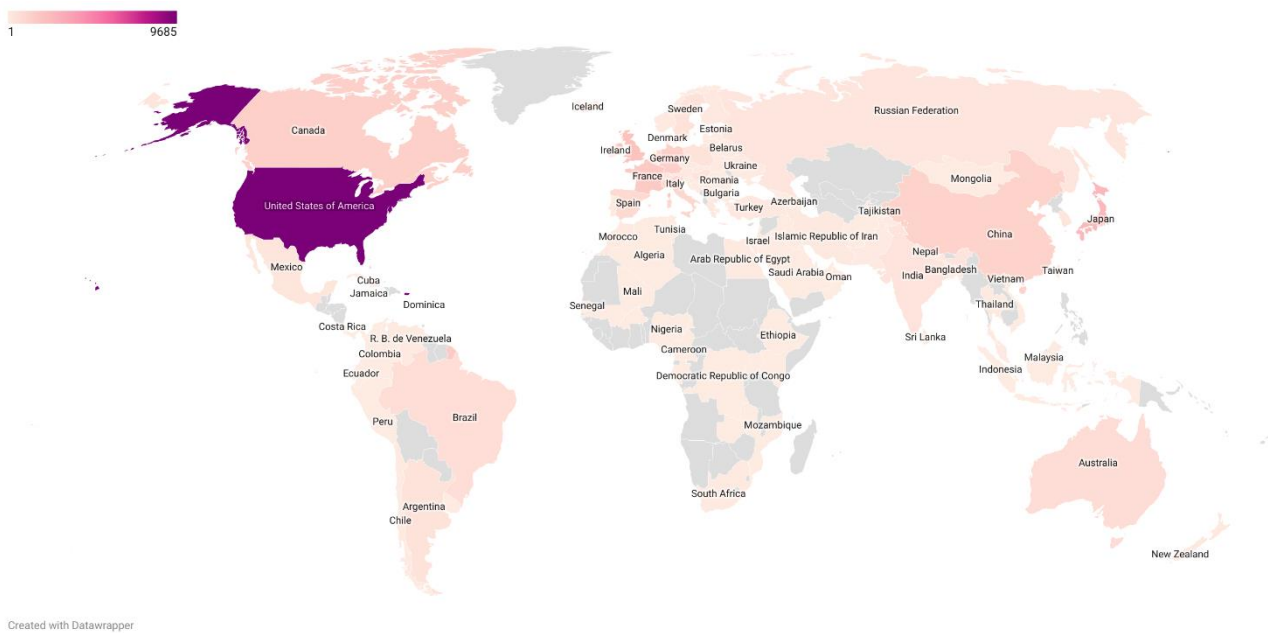
A total of 35919 publications were identified as a result of the literature search, of which 25145 (70.005%) were Article, 6899 (19.207%) Meeting Abstract, 1577 (4.390%) Review, 1300 (3.619%) Proceedings Paper, 908 (2.528%) Note, 361 (1.005%) Editorial Material and the remainder were Letter (295), Correction (199), Book Chapter (190), Early Access (36), Correction Addition (21), Book Review (13), News Item (10), Retracted Publication (8), Discussion (7), Retraction (7), Reprint (5), Book (3) and Data Paper (3). For this study, bibliometric analysis was applied to 25145 publications, categorised as articles. Of these, 97.1% (24426) were published in English, and the remaining articles were in Russian (318), French (162), German (81), Spanish (59), Czech (23), Japanese (19), Ukrainian (18), Chinese (14), Italian (10), Polish (6), Portuguese (4), Dutch (2), Hungarian (1), Slovak (1) and Turkish (1).

### *Development of Publications*

The distribution of 25145 articles between 1980 and 2020 is given in Figure 1. The results of the regression analysis for the estimated number of publications in the future are also shown in the figure. From the regression analysis, it was estimated that 712 (CI 95%: 656-768) articles will be published in 2020 and 723 (650-796) articles in 2032 (Figure 1).



**Figure 1.** Number of publications by years on the hypothalamus



**Figure 2.** The distribution of the most productive countries on the hypothalamus

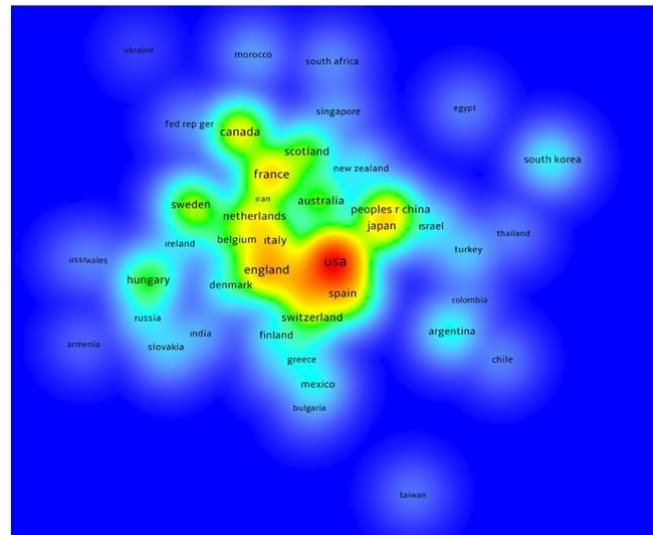
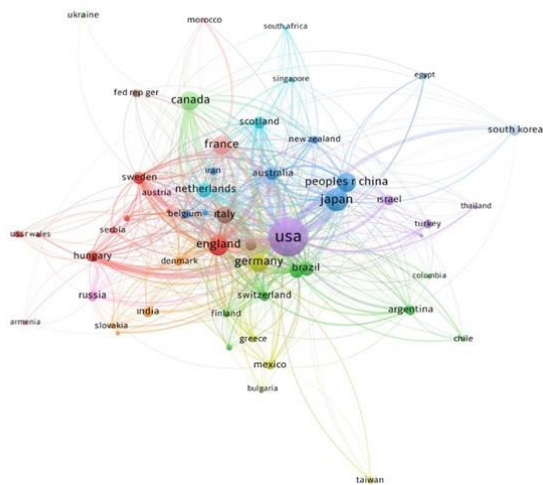
**Active Countries**

The publication distributions of the countries are shown in Figure 2 on the world map. The active countries producing more than 100 articles were seen to be the USA (n=9685), Japan (2636), the UK (2065), France (1608),

Germany (1388), Canada (1347), China (1229), Italy (979), Spain (853), Australia (699), the Netherlands (692), Brazil (685), Poland (429), Sweden (426), Argentina (403), Hungary (403), the USSR (387), Switzerland (375), India (341), South Korea (308), Russia (298), Mexico

(257), Israel (238), Belgium (199), Denmark (194), Taiwan (168), Turkey (158), Finland (137), New Zealand (135), Iran (123), Austria (118) and Greece (109). In addition, an international collaboration network

visualization map and density map between 71 different countries producing at least 15 publications from these countries are presented in Figures 3.a and 3.b, respectively



**Figure 3.** Network visualization map showing the international collaboration of countries on hypothalamus. Footnote: The size of the circle shows a large number of publications; the colours indicate the cluster of collaborations.

### *Correlation Analysis*

A statistically significant positive correlation was found between the number of hypothalamic articles produced by countries and the development indicators of GDP and GDP per capita, ( $r=0.785$ ,  $p<0.001$ ;  $r=0.511$ ,  $p<0.001$  respectively).

### *Active Authors*

The top 10 authors who produced the most articles on the hypothalamus were Pfaff DW ( $n=122$ ), Leibowitz SF (98), Chrousos GP (93), Swaab DF (93), Lightman SL (92), Clarke JJ

(85), Bloom SR. (83), Dieguez C (78), Kalra SP (77), and Ueta Y (77).

### *Active Institutions*

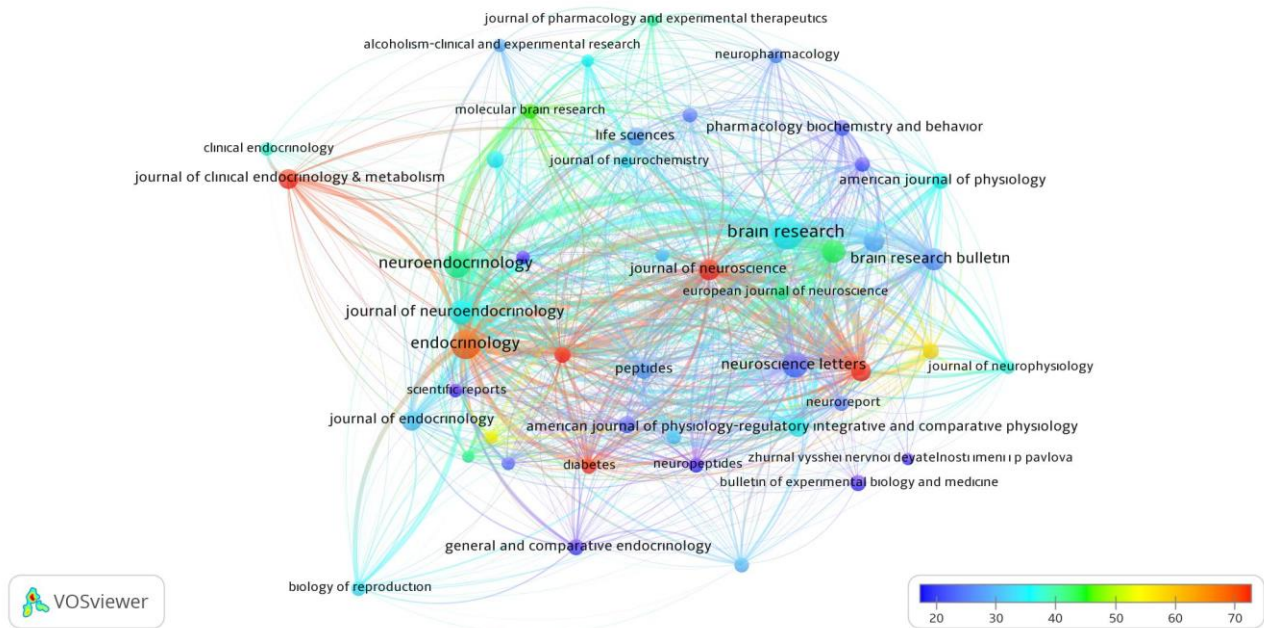
The 13 most productive universities that have produced more than 200 publications on the hypothalamus are the University of Texas ( $n=350$ ), Rockefeller University (338), the University of Sao Paulo (312), the University of California- Los Angeles (296), Harvard University (274), Yale University. (267), the University of Michigan (259), Oregon Health & Science University (254), the University of Toronto (254), the Institut National de la Sante

et de la Recherche Medicale (INSERM) (247), the National Institute of Mental Health (NIMH) (244), the Karolinska Institutet (204), and the Salk Institute for Biological Studies (203).

### Active Research Areas

The top 10 research fields with the most studies on the hypothalamus were found to be Neurosciences (10305; 40.9%), Endocrinology

Metabolism (6985; 27.7%), Pharmacology Pharmacy (2081; 8.2%), Physiology (2018; 8%), Biochemistry Molecular Biology (1760; 6.9%), Behavioral Sciences (1154; 4.5%), Clinical Neurology (1073; 4.2%), Multidisciplinary Sciences (1012; 4%), Cell Biology (943; 3.7%), and Psychiatry (939; 3.7%).



**Figure 4.** Network visualization map for citation analysis of active journals in hypothalamus Footnote: The number of average citations increases from blue to red (blue-green-yellow-red).

### Active Journals

There have been 25145 publications published on the hypothalamus in 2257 different journals, with over 90 articles appearing in 47 of the journals. Table 1 shows the total number of citations attained by these journals, the articles in the journals, and the average number of citations per article. The visualization map of the citation network

between these publications is illustrated in Figure 4.

### Citation Analysis

In Table 2, which includes the average number of citations per year in the last column, the 18 publications with the greatest amount of citations from 1000 of the 25145 articles published on the hypothalamus between 1980 and 2020 are included

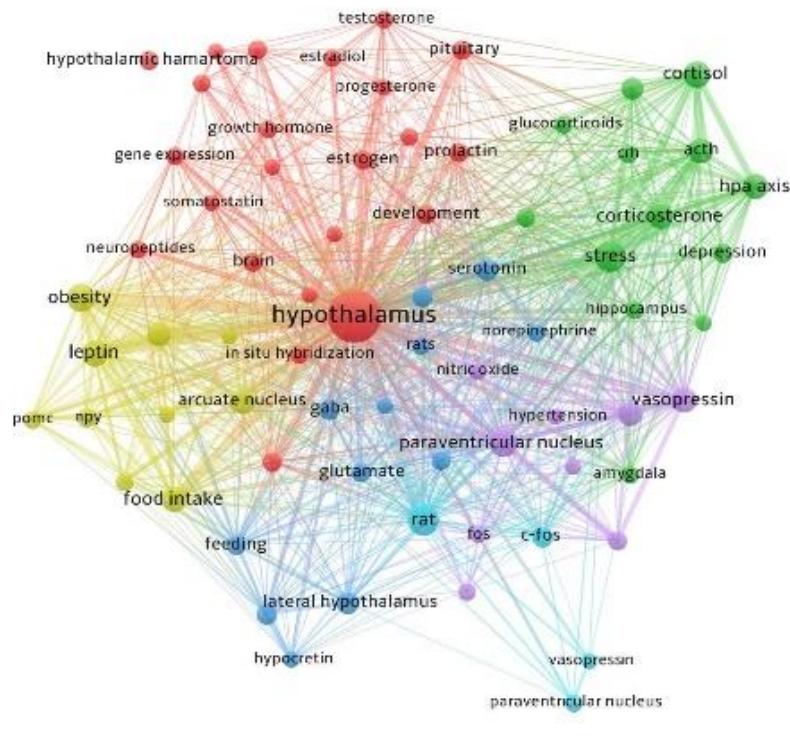
### Co-citation Analysis

There were references to 400,314 unique publications among 25145 articles. These publications contain the first 11 publications with more than 400 citations seen to be in descending order, Lowry OH (1951) (Number of co-citation: 888), Paxinos G (1986) (736), Swanson LW (1980) (700), Schwartz MW (2000) (677), Swanson LW (1983) (562), Bradford MM (1976) (474), Paxinos G (1982) (464), Paxinos G (1998) (451), Sakurai T (1998) (443) , Vale W (1981) (434), and Swanson LW (1980) (421) (16-26).

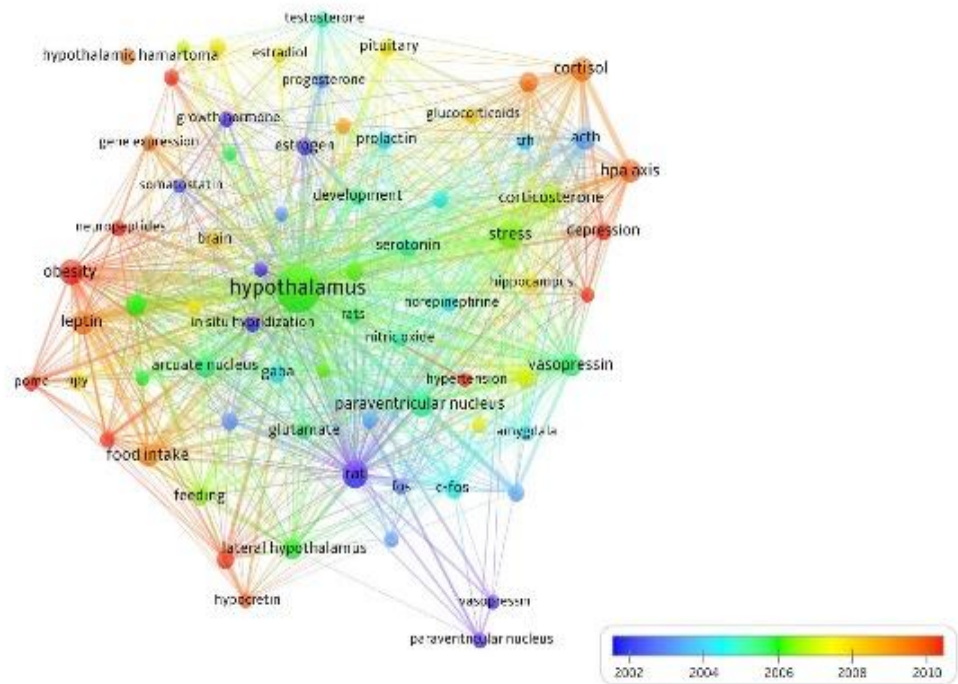
### Keyword Analysis and Trend Topics

In the 25145 articles published on the hypothalamus, were 21432 different keywords

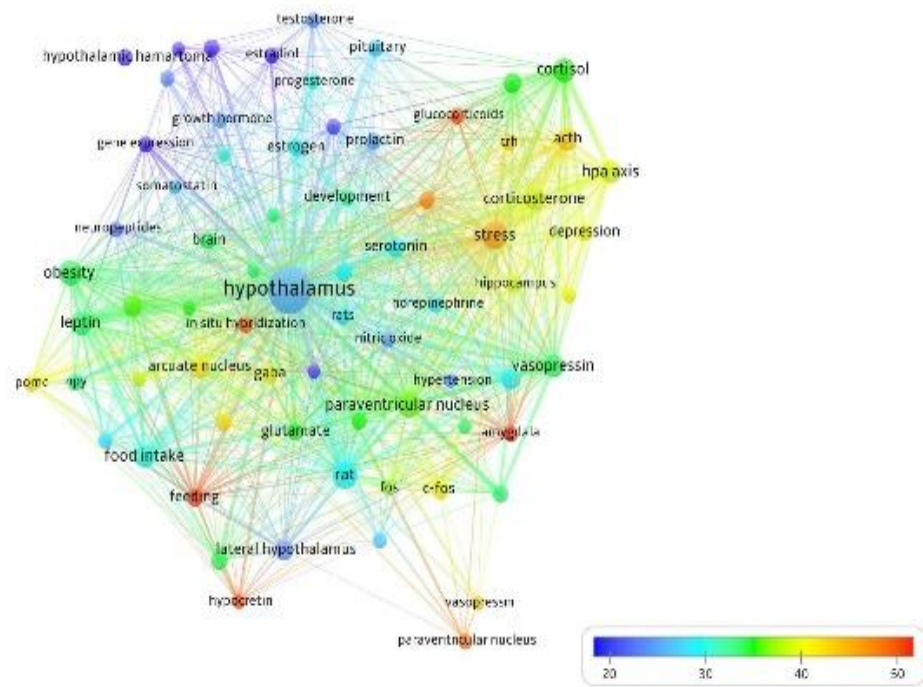
used, 71 of which appeared in at least 100 several publications. These words are given in Table 3To determine the usage association of the keywords used in the studies, a map of network visualization for cluster analysis was drawn and the cluster network visualization map between these keywords is given in Figure 5. The trend visualization network map showing the distribution of keywords used in studies conducted between 1980-2020 by years is given in Figure 6 and the citation network visualization map made to identify effective topics that received more citations is given in Figure 7.



**Figure 5.** Network visualization map showing cluster analysis results based on keyword analysis on hypothalamus  
Footnote: Colours indicate clustering.



**Figure 6.** Network visualization map for trends based on keyword analysis on hypothalamus. Indicator shows current publications from blue to red.



**Figure 7.** Network visualization map for citations based on keyword analysis on hypothalamus. The number of citations increases from blue to red (blue-green-yellow- red).



**Table 1.** Active journals on hypothalamus

Journals	RC	C	AC	Journals	RC	C	AC
Brain Research	1431	51118	35.72	Behavioural Brain Research	159	3615	22.74
Endocrinology	1167	78125	66.95	Diabetes	159	14688	92.38
Neuroendocrinology	872	35332	40.52	Biology of Reproduction	152	5226	34.38
Neuroscience Letters	710	16947	23.87	Regulatory Peptides	149	4737	31.79
Journal of Neuroendocrinology	682	24983	36.63	Neuropeptides	147	2470	16.80
Neuroscience	526	22495	42.77	Cell and Tissue Research	140	4246	30.33
Brain Research Bulletin	464	12784	27.55	European Journal of Pharmacology	139	3571	25.69
Physiology & Behavior	399	11926	29.89	Molecular Brain Research	137	6294	45.94
Journal of Neuroscience	380	34562	90.95	Neuroreport	136	3515	25.85
Journal of Clinical Endocrinology & Metabolism	341	24963	73.21	Neuropharmacology	135	3637	26.94
Journal of Comparative Neurology	324	29379	90.68	Biochemical and Biophysical Research Communications	125	6670	53.36
Journal of Endocrinology	307	9728	31.69	Clinical Endocrinology	123	4719	38.37
Peptides	282	7941	28.16	Journal of Neurochemistry	123	4169	33.89
American Journal of Physiology-Regulatory Integrative and Comparative Physiology	264	9690	36.70	Journal of Neurophysiology	110	4158	37.80
Life Sciences	257	7430	28.91	Neuroendocrinology Letters	110	639	5.81
Psychoneuroendocrinology	220	7804	35.47	Developmental Brain Research	103	3186	30.93
Plos One	212	5049	23.82	Molecular and Cellular Endocrinology	102	2425	23.77
American Journal of Physiology	187	6944	37.13	Alcoholism-Clinical and Experimental Research	101	2987	29.57
Pharmacology Biochemistry and Behavior	187	4466	23.88	Scientific Reports	101	1081	10.70
General and Comparative Endocrinology	183	3812	20.83	Journal of Pharmacology and Experimental Therapeutics	97	3886	40.06
Proceedings of The National Academy of Sciences of the United States of America	175	21801	124.58	American Journal of Physiology-Endocrinology and Metabolism	96	3940	41.04
Bulletin of Experimental Biology and Medicine	171	149	0.87	Zhurnal Vyshei Nervnoi Deyatelnosti Imeni I P Pavlova	94	183	1.95
European Journal of Neuroscience	170	6952	40.89	Hormones and Behavior	93	3383	36.38
Journal of Physiology-London	167	9414	56.37				

RC: Record Count, C: Number of Citation, AC: Average Citation Per Document

**Table 2.** The 18 most cited articles on hypothalamus

No	Article	Author	Journal	PY	TC	AC
1	Characterization of a 41-residue ovine hypothalamic peptide that stimulates secretion of corticotropin and beta-endorphin	Vale, W. <i>et al.</i>	Science	1981	4160	101.46
2	Orexins and orexin receptors: a family of hypothalamic neuropeptides and G protein-coupled receptors that regulate feeding behavior	Sakurai, T. <i>et al.</i>	Cell	1998	3691	153.79
3	The hypocretins: hypothalamus-specific peptides with neuroexcitatory activity	De Lecea, L. <i>et al.</i>	Proceedings of the National Academy of Sciences of the United States of America	1998	2695	112.29
4	Maternal care, hippocampal glucocorticoid receptors, and hypothalamic-pituitary-adrenal responses to stress	Liu, D. <i>et al.</i>	Science	1997	2175	87
5	Isolation of a novel-38 residue-hypothalamic polypeptide which stimulates adenylate-cyclase in pituitary-cells	Miyata, A. <i>et al.</i>	Biochemical and Biophysical Research Communications	1989	1653	50.09
6	A receptor in pituitary and hypothalamus that functions in growth hormone release	Howard, AD. <i>et al.</i>	Science	1996	1585	60.96
7	Leptin inhibits bone formation through a hypothalamic relay: a central control of bone mass	Ducy, P. <i>et al.</i>	Cell	2000	1504	68.36
8	Cholinergic innervation of cortex by the basal forebrain - cyto-chemistry and cortical connections of the septal area, diagonal band nuclei, nucleus basalis (substantia innominata), and hypothalamus in the rhesus-monkey	Mesulam, MM. <i>et al.</i>	Journal of Comparative Neurology	1983	1455	37.31
9	Interleukin-1 stimulates the secretion of hypothalamic corticotropin-releasing factor	Sapolsky, R. <i>et al.</i>	Science	1987	1440	41.14
10	Hypothalamic-pituitary-adrenal axis, neuroendocrine factors and stress	Tsigos, C. <i>et al.</i>	Journal of Psychosomatic Research	2002	1428	71.4
11	Identification of targets of leptin action in rat hypothalamus	Schwartz, MW. <i>et al.</i>	Journal of Clinical Investigation	1996	1261	48.5
12	Early, postnatal experience alters hypothalamic corticotropin-releasing factor (CRF) messenger-rna, median-eminence CRF content and stress-induced release in adult-rats	Plotsky, PM. <i>et al.</i>	Molecular Brain Research	1993	1248	43.03
13	The novel hypothalamic peptide ghrelin stimulates food intake and growth hormone secretion.	Wren, AM. <i>et al.</i>	Endocrinology	2000	1233	56.05
14	Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis	Kirschbaum, C. <i>et al.</i>	Psychosomatic Medicine	1999	1228	53.39
15	The paraventricular nucleus of the hypothalamus - cytoarchitectonic subdivisions and organization of projections to the pituitary, dorsal vagal complex, and spinal-cord as demonstrated by retrograde fluorescence double-labeling methods	Swanson, LW. <i>et al.</i>	Journal of Comparative Neurology	1980	1207	28.74
16	AMP-kinase regulates food intake by responding to hormonal and nutrient signals in the hypothalamus	Minokoshi, Y. <i>et al.</i>	Nature	2004	1156	64.22
17	The distribution and mechanism of action of ghrelin in the CNS demonstrates a novel hypothalamic circuit regulating energy homeostasis	Cowley, MA. <i>et al.</i>	Neuron	2003	1139	59.95
18	Postnatal microbial colonization programs the hypothalamic-pituitary-adrenal system for stress response in mice	Sudo, N. <i>et al.</i>	Journal of Physiology-London	2004	1089	60.5

PY: Publication year, TC: Total citation, AC: Average citations per year

**Table 3.** The most used trend keywords on hypothalamus

Keyword	O	Keyword	O	Keyword	O
hypothalamus	3736	development	194	blood pressure	137
stress	698	depression	192	glucocorticoids	136
rat	676	corticotropin-releasing hormone	189	crh	135
obesity	573	brain	187	rats	132
paraventricular nucleus	543	glutamate	183	kisspeptin	131
cortisol	469	gnrh	177	estradiol	129
leptin	450	pituitary	177	hippocampus	129
food intake	415	supraoptic nucleus	177	growth hormone	125
corticosterone	413	prolactin	176	fos	123
hpa axis	397	estrogen	174	ventromedial hypothalamus	122
vasopressin	381	microdialysis	172	insulin	116
acth	369	immunohistochemistry	170	puberty	116
arcuate nucleus	365	npv	163	vasopressin	116
oxytocin	343	gene expression	155	preoptic area	112
neuropeptide y	302	testosterone	154	immunocytochemistry	108
lateral hypothalamus	294	in situ hybridization	153	hypothalamic paraventricular nucleus	106
hypothalamic-pituitary-adrenal axis	291	norepinephrine	153	anxiety	105
serotonin	247	ghrelin	148	gonadotropin-releasing hormone	105
dopamine	229	amygdala	147	proopiomelanocortin	104
orexin	217	nitric oxide	147	somatostatin	102
c-fos	213	pomc	146	hypertension	101
gaba	208	aging	142	hypocretin	101
feeding	196	neuropeptides	139	progesterone	101
hypothalamic hamartoma	195	paraventricular nucleus	139		

O: Number of occurrences

## DISCUSSION

The number of articles published on the hypothalamus was 591 in 1980 and 711 in 2020. From the regression analysis results was projected that interest in the hypothalamus will continue, and accordingly, the number of articles on this subject will increase to reach an estimated 723 by the end of 2032.

Of the 10 countries that produce articles about the hypothalamus the most, 9 were the USA, Japan, the UK, France, Germany, Canada, Italy, Spain, and Australia, all of which are developed countries with strong economies. The effectiveness of developed countries in the productivity of publications shows that the productivity of publications on the subject of the hypothalamus is directly

related to economic power. Although classified as a developing country, China has managed to become one of the top ten most active countries as a result of its growing economy and support for scientific studies. The statistically significant correlation analysis results also confirmed the hypothesis of the association between article productivity and some development indicators.

When the cooperation between the countries was evaluated, it was seen that although there was some cooperation based on geographical proximity (Brazil, Argentina, Chile, Colombia), the geographical region did not have a great effect on cooperation. These findings are in contrast to findings in the literature on this issue. Previous bibliometric studies in the literature, on the other hand, have generally focused on specific diseases such as carpal tunnel syndrome, celiac disease, or diabetic retinopathy, and so a possible reason for the difference in these findings could be that the hypothalamus is a relatively more universal subject for which there is a constant worldwide demand for research, independent of geographical cooperation.

The journals with the most published articles were determined to be Brain Research, Endocrinology, Neuroendocrinology, Neuroscience Letters, Journal of Neuroendocrinology, Neuroscience, Brain Research Bulletin, Physiology & Behavior, Journal of Neuroscience, Journal of Clinical

Endocrinology & Metabolism, Journal of Comparative Neurology, and Journal of Endocrinology, respectively. Authors who want to publish on the hypothalamus can prioritize these journals. The Proceedings of the National Academy of Sciences of the United States, Diabetes, Journal of Neuroscience, Journal of Comparative Neurology, and the Journal of Clinical Endocrinology and Metabolism were found to be the most productive journals when the results of the citation network visualization map analysis of the journals were evaluated. Therefore, it can be suggested that researchers who want their articles to be read more and be cited more should first consider these journals.

The most cited study, according to the total number of citations received, was published in the journal Science by Vale et al. and was titled "Characterization of a 41-residue ovine hypothalamic peptide that stimulates the secretion of corticotropin and beta-endorphin" (25). In this study, a peptide with 41 residues that induces the release of immunoactivities similar to corticotropin and 1-endorphin in both vitro and in vivo was purified, its sequence was analyzed, and its whole synthesis was described. According to the authors, this peptide may play an important role in mediating and integrating an organism's endocrine, visceral, and behavioral responses to stress (25). The second most cited study was by Sakurai et al. published in Cell journal,

entitled “Orexins and orexin receptors: A family of hypothalamic neuropeptides and G protein-coupled receptors that regulate feeding behavior” (24). In this study, the authors discovered two new neuropeptides, Orexin-A and -B, that are derived from the same precursor via proteolytic processing and bind to and activate two previously unknown orphan G protein-coupled receptors. Following these two studies, the most cited studies were De Lecea et al. 'The hypocretins: Hypothalamus-specific peptides with neuroexcitatory activity' published in the Proceedings of the National Academy of Sciences of the United States of America and a study by Liu et al. published in the journal Science, entitled “Maternal care, hippocampal glucocorticoid receptors, and hypothalamic-pituitary-adrenal responses to stress” (27,28). This study examined the behavior of mothers during the first ten days of life is "critical" for scratching effect on HPA (hypothalamic-pituitary-adrenal) development. It was stated that neonatal programming occurs in response to changes in maternal behavior by differentiating the glucocorticoid receptor system in forebrain neurons that govern HPA axis (loop) activity. When the studies were evaluated based on the average number of citations per year, Sakurai et al., De Lecea et al., and Vale et al. had the top three most influential cited articles (24,25,27). Influential articles with the most average citations ranked

fourth, fifth, and sixth were by Thaler et al. entitled “Obesity is associated with hypothalamic injury in rodents and humans” published in the Journal of Clinical Investigation, by Liu et al., and by Tsigos et al. published in the Journal of Psychosomatic Research entitled “Hypothalamic-pituitary-adrenal axis, neuroendocrine factors, and stress” (28-30). According to the co-citation numbers of all the analyzed articles, Lowry (1951), Paxinos (1986), Swanson (1980), Schwartz (2000), Swanson (1983), Bradford (1976), Paxinos (1982), Paxinos (1998), Sakurai (1998), Vale (1981), and Swanson (1980) were identified as the most influential (16-26). For researchers interested in the subject of the hypothalamus or planning new research, evaluating the above-mentioned studies and other studies in the table first may be beneficial in terms of producing higher quality, more effective studies.

When the results of the keyword analysis were analyzed, it was discovered that the cluster analysis had produced 6 distinct colored clusters. The hypothalamus studies were conducted in 6 different clusters, with the keywords rat, lateral hypothalamus, obesity, aging, stress, and paraventricular nucleus at the center, according to the results of the keyword clustering analysis. The paraventricular nucleus, obesity, and stress-centered clusters stand out as major study clusters.

When the results of the analysis made to state the trend topics of the hypothalamus articles from the past to the present were evaluated, the most used keywords before and after 2002 were determined to be rat, vasopressin, fos, paraventricular nucleus, growth hormone, estrogen, somatostatin, progesterone, and in situ hybridization. Before and after 2004, paraventricular nucleus, c-fos, GABA, prolactin, norepinephrine, prolactin, and testosterone were the most used keywords, and before and after 2006, these were seen to change to the arcuate nucleus, rats, stress, vasopressin, glutamate, lateral hypothalamus, and feeding. The most used keywords before and after 2008 were pituitary, estradiol, neuropeptide Y (npY), cortisol, HPA axis, leptin, food intake hypothalamic hamartoma, gene expression, and cortisol. In 2010 and after, the most preferred keywords were obesity, depression, proopiomelanocortin (POMC), and neuropeptides. When the keywords used in hypothalamus studies conducted after 2010 were evaluated, it was seen that the subject of research was the role of the hypothalamus in mood disorders, eating habits, and sexual behaviors. From the analysis of the keywords used in the hypothalamus articles, it can be seen that they were the subject of many different disciplines in terms of subject and content in the fields of the neuroendocrine system, physiology, neurology, psychiatry, behavioral sciences,

nutrition and dietetics, and anatomical morphology.

Obesity, kisspeptin, neuropeptides, anxiety, depression, orexin, ghrelin, POMC, hypertension, and hypocretin were the trend keywords used most recently when the most commonly investigated (more than 100) terms on the hypothalamus were assessed according to publication years. Feeding, amygdala, hypocretin, glucocorticoids, in situ hybridization, and paraventricular nucleus were the search terms most frequently used in cited papers.

A limitation of this study could be said to be that the literature search was only made using the WoS database, and the Pubmed, Scopus EBSCO, ProQuest, Google Scholar, Crossref, Index Copernicus and Publons databases etc. were not searched. It was decided not to use the Pubmed database because citation analysis could not be performed, and the Scopus database was not selected because there were journals with low impact levels in the database. Since journals with high impact factors are indexed in the WoS database, WoS is a more reliable database in terms of citation compared to other databases (31-38). In addition, the use of more than one database in studies in which a large number of articles are analyzed causes the same article to be included in the analysis more than once, which affects the reliability of the results. Therefore, the WoS database has

been used in many bibliometric studies conducted in recent years (31-38).

**Ethics Committee Approval:** Ethical approval is not required for this study as the present study was related to statistical analyzes of the publications in WoS database.

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