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Morphology in the last 10 years: a bibliometric analysis

Son 10 yılda morfoloji: bibliyometrik bir analiz

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Abstract

Purpose: Morphology is the science of structure, function and development. Many different disciplines work in this field of science.

Bibliometric analysis is a method that examines the productivity, efficiency and performance of factors such as author, country and university.

Materials and methods: In this study, the researches conducted in the field of morphology in the last 10 years were analyzed bibliometrically.

Results: It was analyzed that 83214 studies were conducted in the last 10 years, the most studies were conducted at the Temerty Faculty of Medicine of the University of Toronto, the United States of America as the country and SCI-Expanded index. Elsevier publishing house is the most used publishing house and neuroscience is the field of science with the highest number of publications.

Conclusion: Studies in the field of morphology, which has shed light on other branches of science throughout history, have been increasing in the last 10 years. In our study, it is aimed to guide scientists who will conduct research in the field of morphology in the future.

Keywords: Morphology, bibliometric analysis, medicine.

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Öz

Amaç: Morfoloji yapı, fonksiyon ve gelişme bilimidir. Bu bilim alanında pek çok farklı disiplin çalışmaktadır.

Bibliyometrik analiz yazar, ülke, üniversite gibi faktörlerin üretkenliğini, etkililiğini ve performansını inceleyen bir yöntemdir.

Gereç ve yöntem: Bu çalışmada son 10 yılda morfoloji alanında yapılan araştırmalar bibliyometrik olarak analiz edilmiştir.

Bulgular: Son 10 yılda 83214 çalışmanın yapıldığı, ülke olarak en fazla çalışmanın Amerika Birleşik Devletleri Toronto Üniversitesi Temerty Tıp Fakültesi'nde yapıldığı ve SCI-Expanded indeksi analiz edildi. Elsevier yayınevi en çok kullanılan yayınevi olup sinir bilimi ise en fazla yayına sahip bilim alanıdır.

Sonuç: Tarih boyunca diğer bilim dallarına ışık tutan morfoloji alanında yapılan çalışmalar son 10 yılda artış göstermektedir. Çalışmamızda gelecekte morfoloji alanında araştırma yapacak bilim insanlarına yol gösterilmesi amaçlanmaktadır.

Anahtar kelimeler: Morfoloji, bibliyometrik analiz, tıp.

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Introduction

Morphology is the branch of science that studies the structure and anatomical form of living things and investigates their physical properties. It examines the physiological forms of living organisms, such as organs and systems, as well as other structural features of living organisms. The Department of Morphology consists of various disciplines, including cell and developmental biology, genetics and molecular medicine [1]. The sentence 'Morphology is a good witness that does not lie' actually tells us in a good way that the structural features of the living creature are defined by morphology [2].

Morphology, which comes from the Greek word morph, which means shape and form, defines both the formal properties and physical activities of the living structure. It analyses and defines from the smallest physical structure to the whole body as a whole [3].

Bibliometrics is of Greek origin and means book and measurement [4]. Today, its use can be described as measuring, that is, analysing the publications resulting from the studies carried out. Bibliometric analyses provide cumulative information by analysing the publications made and indexed in a scientific field, their characteristics and literature status [5]. In these analyses, publications in the literature are examined quantitatively using statistical methods. Bibliometric study aims to determine which topics current research focuses on. In this way, it helps researchers to plan future research by using the information obtained from past research.

Bibliometric analysis provides a different perspective in reflecting developments in various fields of scientific research. This analysis is a useful method to objectively measure the current status and international scientific impact of a particular topic. At the same time, it provides researchers and readers with a concise and understandable overview of general trends in research areas [6].

Bibliometrics is a research approach used to measure and analyse the impact of scientific studies on a particular research. Bibliometrics is a meta-science study that makes science the object of study. Bibliometrics uses three elements of scientific activity as a basis: input, output and impact of a publication. These three elements can then be mapped and used to expand knowledge in a particular research area. This study clarifies the interrelationships between authors, publications, institutions and other characteristics of a given field [7]. It is also a systematic, transparent and reproducible review process based on a statistical approach to provide an overview of the current state of the literature in a given field through the analysis of published literature [8].

Bibliometric analysis is a method that shows the productivity and impact of research and the performance of authors. In particular, the number of citations is one of the indicators of the level of impact of an article in the relevant field. In this way, scientists and clinicians interested in the field of study can focus on the results of influential articles [9]. In addition, bibliometric studies also give an idea about the future vision of a journal. Although there are studies using bibliometric methods in various fields in the literature, there are very few bibliometric studies in the field of anatomy and there are no bibliometric studies on anatomy journals. Citation analysis is the most widely used form of bibliometrics and allows to measure the impact factor of journals [10]. The influence of an author and an article is often measured by the number of citations. The number of citations an article receives is one of the measures of its scientific value [11]. However, the scientific rigour of an article and its impact on clinical practice cannot be measured solely on the basis of the citations it receives [12].

Web of Science (WoS) database is one of the databases widely used in bibliometric research. The most valid measure of the quality of scientific publications and the productivity of researchers at the international level is the number of articles published in journals in the WoS database and the number of citations to these articles. All these criteria can be interpreted as a quality indicator and can be used to evaluate institutions, academics and even countries [13]. VOS viewer is a specially designed software tool that creates and visualises bibliometric maps, thus showing structural and dynamic aspects of scientific research fields. The popularity of bibliometric studies is steadily increasing. The progress, usability and accessibility of bibliometric software such as

VOS viewer, the interdisciplinary characteristics of bibliometric methodologies, its usefulness for large-scale processing of scientific data and its high research impact are directly linked to the popularity of bibliometric studies [7].

The aim of this study is to guide scientists doing research on this subject by determining which publications on morphology are most cited, who contributed to them, and what topics they deal with.

Materials and methods

Permission was received for the study from Pamukkale University Ethics Committee.

Data collection

The Web of Science online database was searched to identify the publications that mentioned 'Morphology' in their titles, abstracts or keywords. To systematically exclude irrelevant publications, the search strategy was designed as follows: TS= Morphology and PY=2013-2022. ((TS=(morphology)) or (QMTS=("Morphology")) and (PY=("2022" or "2021" or "2020" or "2019" or "2018" or "2017" or "2016" or "2015" or "2014" or "2013") and TASCA=("Physiology" or "Obstetrics Gynecology" or "Ophthalmology" or "Rehabilitation" or "Cell Biology" or "Neurosciences" or "Rheumatology" or "Tropical Medicine" or "Geriatrics Gerontology" or "Medicine Legal" or "Medical Informatics" or "Psychology" or "Critical Care Medicine" or "Emergency Medicine" or "Hematology" or "Anthropology" or "Chemistry Medicinal" or "Surgery" or "Microbiology" or "Anatomy Morphology" or "Anesthesiology" or "Dermatology" or "Nutrition Dietetics" or "Pediatrics" or "Genetics Heredity" or "Pathology" or "Dentistry Oral Surgery Medıcıne" or "Orthopedics" or "Psychiatry" or "Urology Nephrology" or "Clinical Neurology" or "Medicine General Internal") and Edn=("Wos. SCI" or "Wos.ESCI" or "Wos.SSCI" or "Wos. ISTP") and Py=("2022" or "2021" or "2020" or "2019" or "2018" or "2017" or "2016" or "2015" or "2014" or "2013")) Booleans: And, Or, Not Field Tags: TS=Topic, TI=Title, AB=Abstract, AU=Author, AI=Author Identifiers, AK=Author Keywords, PY=Year Published, WC=Web of Science Categories.

Data processing and analyzing

Publications related to morphology were identified, bibliometric data were extracted and evaluated. The selected parameters were the number of citations, study type, first author's name, university, year of publication and country.

The identified publications were ranked in descending order according to the number of citations. The VOS viewer software was used with default parameters to create a bubble map that analyses and visualises the words/ sentences used in the titles and abstracts of publications. Collaboration between countries was established with the VOS viewer software. VOS viewer is a software designed to visualise bibliometric data [14]. VOS viewer, is a software that gives special attention to the graphical representation of bibliometric maps [14].

Results

When the studies conducted in the last 10 years are examined, it is seen that there are a total of 83214 studies, 72446 of which are articles, 6115 review articles, 2903 meeting abstracts, 950 proceeding papers, 885 editorial materials, 362 early access (Figure 1).

When the studies were listed to evaluate them in terms of citations, it was seen that the most cited study was 'the third international consensus definitions for sepsis and septic shock' by Singer et al. [15], with 12596, and the following study was also a consensus conference study (Table 1). The 10 most cited studies were written in English and listed regardless of the years (Table 1).

When the university departments where the studies were conducted were evaluated, the top 5 universities were University Of Toronto Temerty Faculty Of Medicine with 425 publications, Stanfort Medicine with 412 publications, Stanford University school of Medicine with 412 publications, Washington University in St Louis School of Medicine with 387 studies and University College London School of Life and Medical Sciences with 362 studies (Table 2).

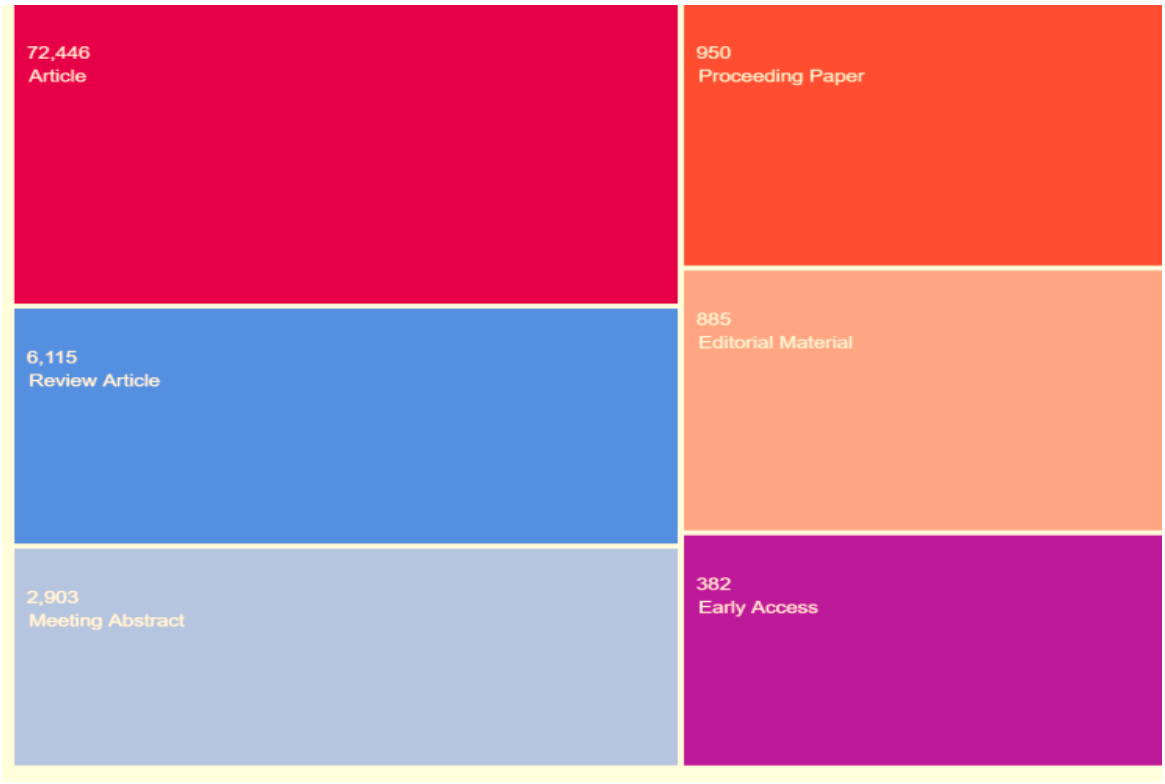

Figure 1. Document type visualization

Table 1. Top 10 most cited publications

	Article Title	Authors	Citation
1	The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)	Singer, M; Deutschman, CS; Seymour, CW	12596
2	The 2014 International Society of Urological Pathology (ISUP) Consensus Conference on Gleason Grading of Prostatic Carcinoma Definition of Grading Patterns and Proposal for a New Grading System	Epstein, JI; Egevad, L; Amin, MB	1896
3	The gut microbiota of insects - diversity in structure and function	Engel, P; Moran, NA	1380
4	The Chicago Classification of esophageal motility disorders, v3.0	Kahrilas, PJ; Bredenoord, AJ; Fox, M; Gyawali, CP; Roman, S; Smout, AJPM; Pandolfino, JE	1326
5	Neurotrophin regulation of neural circuit development and function	Park, H; Poo, MM	1302
6	Mechanisms of Plaque Formation and Rupture	Bentzon, JF; Otsuka, F; Virmani, R	1251
7	Clonal hematopoiesis of indeterminate potential and its distinction from myelodysplastic syndromes	Steensma, DP; Bejar, R; Jaiswal, S	1226
8	Signaling mechanisms of the epithelial-mesenchymal transition	Gonzalez, DM; Medici, D	1127
9	Resting-state connectivity biomarkers define neurophysiological subtypes of depression	Drysdale, AT; Grosenick, L; Downar, J	1102
10	Effect of Essential Oils on Pathogenic Bacteria	Nazzaro, F; Fratianni, F; De Martino, L	1046

Table 2. University department visualization

Affiliation with Department	Count
Johns hopkıns unıversıty school of medıcıne	530
Shanghaı medıcal unıversıty 2	508
Stanford medıcıne	476
Stanford unıversıty school of medıcıne	470
Unıversıty college london school of lıfe and medıcal scıences	470
Johns hopkıns medıcıne	424
Unıversıty of calıfornıa san francısco school of medıcıne	418
Unıversıty of toronto temerty faculty of medıcıne	414
Unıversıty of pıttsburgh schools of the health scıences	409
Washıngton unıversıty ın st louıs school of medıcıne	383
Yale school of medıcıne	363
Uw medıcıne	362
Unıversıty of pıttsburgh school of medıcıne	361
Unıversıty of washıngton school of medıcıne	359
The unıversıty of melbourne faculty of medıcıne dentıstry and health scıences	358
Unıversıty of mıchıgan mıchıgan medıcıne	349
Harvard medıcal school	338
Unıversıty of mıchıgan school of medıcıne	336
West chına center of medıcal scıences	336
Perelman school of medıcıne	324

When the countries where broadcasts are made are examined, they are in the top 10 as USA, followed by China, Germany, England, Japan, Italy, Canada, Brazil, India and France (Figure 2).

When the publications are examined as index, 76162 publications are SCI-Expanded, 6172 publications are ESCI, 4621 publications are SSCI, 2827 publications are CPCI-S, 495 publications are A&HCI, 203 publications are BKCI-S, 127 publications are IC, 16 publications are CPCI-SSH.

Considering the publication language of the studies, it is seen that 82026 studies were published in English, 391 studies in German, 363 studies in Spanish, 102 studies in French, 97 studies in Russian, 64 studies in Turkish, 30 studies in Portuguese, 26 studies in Polish, 24 studies in Czech, and 19 studies in Korean (Figure 3).

Data taken from the web of science website with the WOS viewer program are shown according to years. This chart evaluates the 500 most cited studies in the last 10 years (Figure 4). A total of 34 authors in 6 clusters are associated with each other and shown in (Figure 4). In this figure, it can be seen that the authors refer to each other regardless of the years.

When Most published Authors are analysed, there is no author in the top 20 and the first 5 authors are Warren Alan, Antonescu Cristina R., Alfarraj Saleh, Agaimy Abbas, Khaled AL-Rasheid (Table 3).

Looking at the WOS Categories Cell Biology, Neurosciences, Surgery, Microbiology, Anatomy Morphology, Genetics Heredity, Pathology, Dentistry Oral Surgery Medicine, biochemistry Molecular Biology and Orthopedics are ranked as the top 10 (Table 4).

When looking at the publishing house information, it is seen that Elsevier is at the top with 17957 publications, followed by Wiley and Springer natural publishing houses (Table 5).

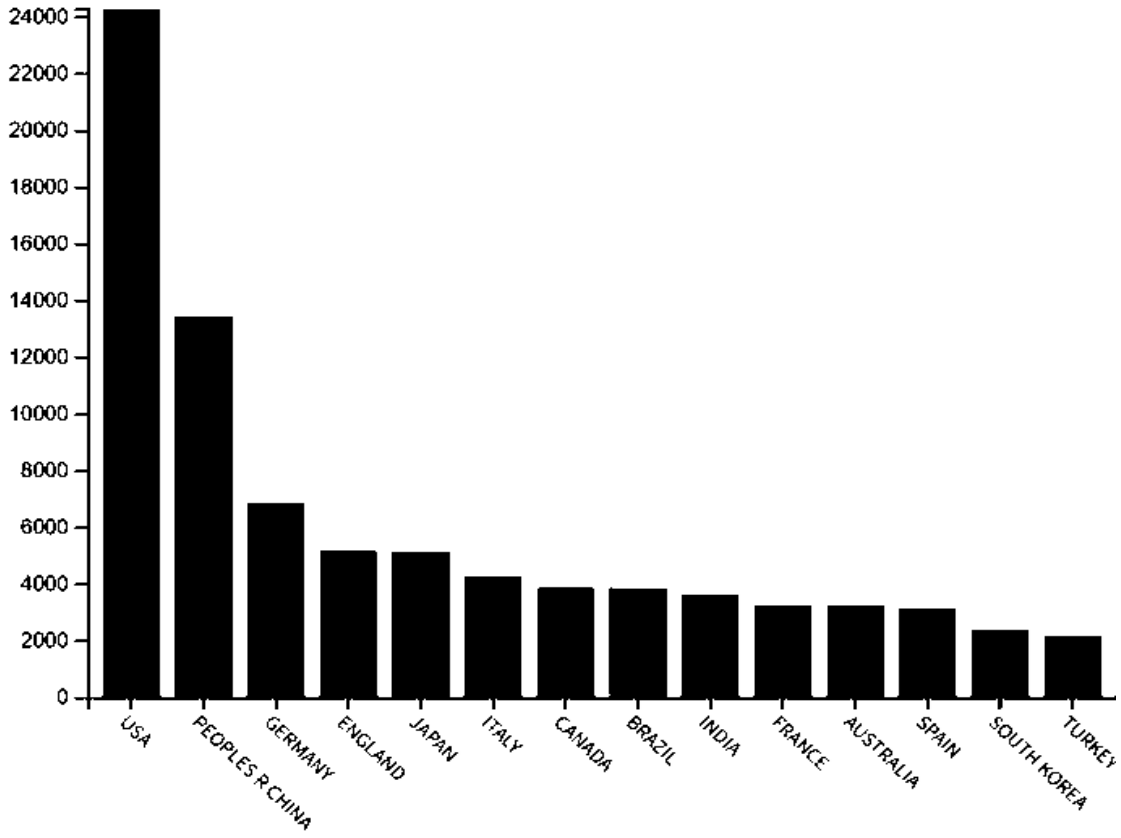

Figure 2. Country visualization

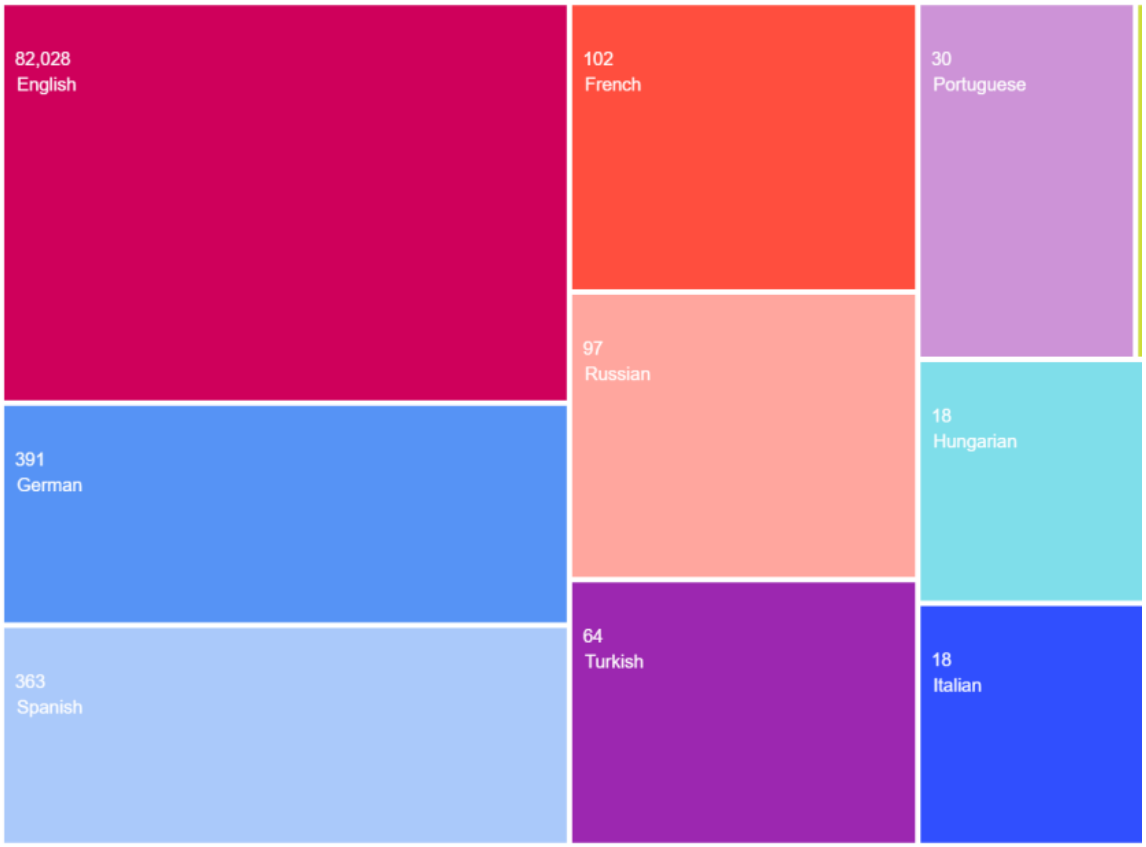

Figure 3. Language visualization

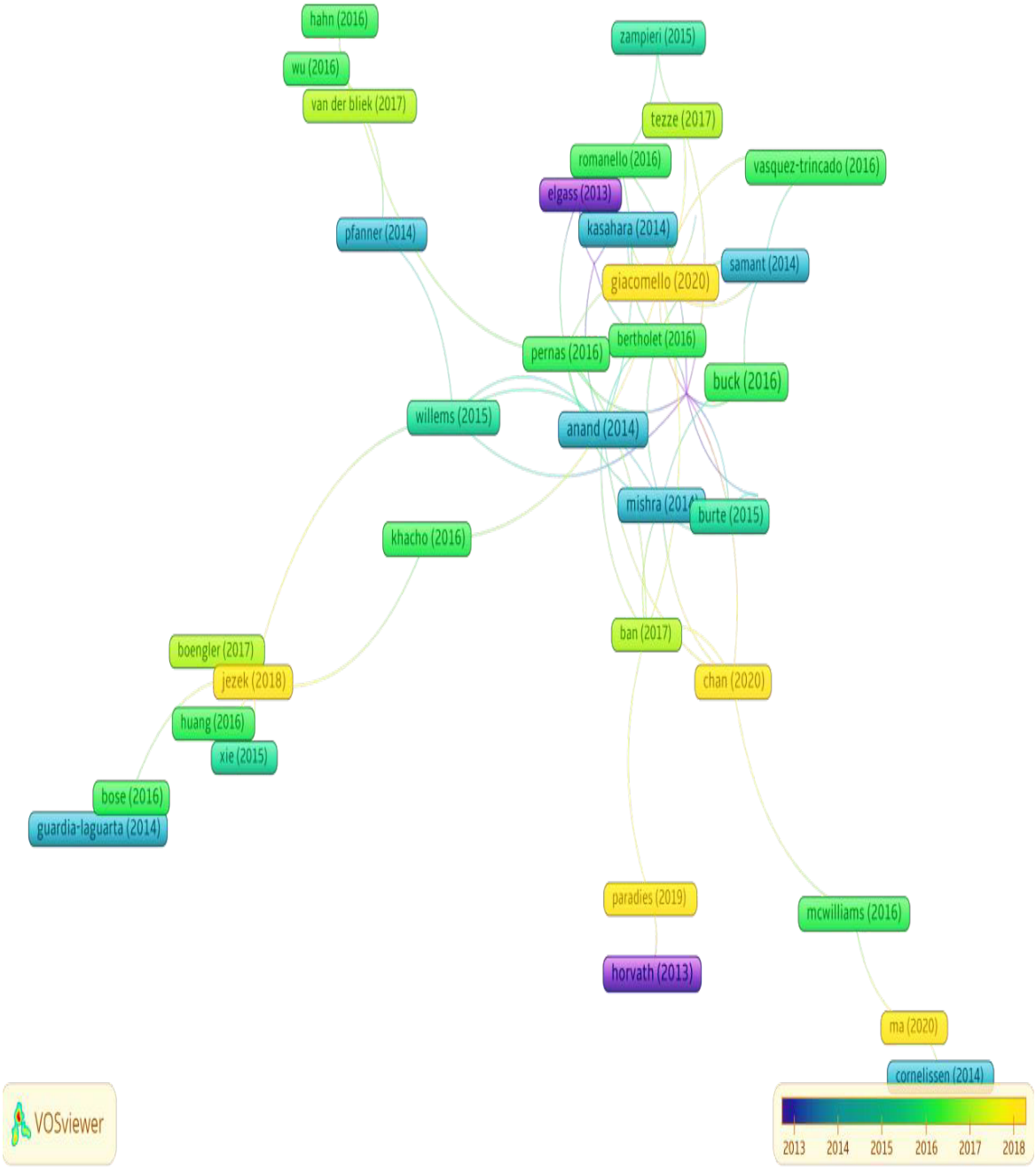

Figure 4. WOS viever graphic for years by citation

Table 3. Most published Authors

Researcher Profiles	Count
Warren, Alan	93
Antonescu, Cristina R.	80
Alfarraj, Saleh	56
Agaimy, Abbas	55
Khaled AL-Rasheid	54
Ahmad, Mushtaq	54
Zafar, Muhammad	53
Flores, Gonzalo	51
Sultana, Shazia	50
Tubbs, R. Shane	49
Zhang, Lei	49
Michal, Michael	47
Cheng, Liang	46
White, Tonya	46
Hes, Ondrej	46
Oliva-Poch, Ester	45
Epstein, Jonathan I.	45
Hu, Xiaozhong	44
Iwanaga, Joe	43
Ahmad, Prof. Dr. Mushtaq	42

Table 4. WOS Categories

Web of Science Categories	Count
Cell bıology	11039
Neurosclences	10231
Surgery	6910
Mıcrobıology	5958
Anatomy morphology	5816
Genetıcs heredıty	5466
Pathology	5259
Dentıstry oral surgery medıcıne	5207
Bıochemıstry molecular bıology	4875
Orthopedıcs	4558
Clınıcal neurology	4188
Medıcıne general ınternal	4095
Ophthalmology	3862
Obstetrıcs gynecology	3031
Physıology	2952
Evolutıonary bıology	2925
Chemıstry medıcınal	2173
Pharmacology pharmacy	2049
Bıotechnology applıed mıcrobıology	2030
Anthropology	2020

Table 5. Publisher

Publishers	Count
Elsevier	18071
Springer Nature	13503
Wiley	13471
Frontiers Media Sa	3466
Lippincott Williams & Wilkins	3460
Oxford Univ Press	2686
Mdpi	2314
Taylor & Francis	2036
Sage	1722
Assoc Research Vision Ophthalmology Inc	888
Karger	783
Amer Soc Microbiology	736
Mary Ann Liebert, Inc	734
Wolters Kluwer Medknow Publications	730
Hindawi Publishing Group	687
Amer Physiological Soc	618
Bmj Publishing Group	498
Soc Chilena Anatomia	489
Thieme Medical Publishers	466

Discussion

Morphology is an important and broad branch of science covering many branches of science, especially medicine [2]. When morphology in the field of medicine is analysed, it is revealed that neuroscience, cell biology and surgical sciences make a great contribution to morphology (Table 4). The place of the anatomy department in morphology is not at the top of the list as it may first come to mind, but it ranks 7th with 5816 publications (Table 4). In the study of Petekkaya et al. [16], it is seen that anatomy increased after 1997. When examined in more detail, it was seen that radiological anatomy was at the forefront [16]. The year with the most publications related to anatomical terminology obtained was in 2020 [7]. In the field of anatomy, especially in education, studies related to technology are also increasing. An example of this is virtual reality technologies. With the development of science and technology, VR will have a wider application in the field of anatomy and will also become a powerful modern teaching method in medical research institutions [17]. In the field of anatomy, Ankara University and Hacettepe University are ranked in the top 2 in Türkiye [4].

Morphology should not be considered only as a branch of basic sciences, on the contrary, it should not be forgotten that it examines all processes starting from gynaecology and obstetrics and foetus and continuing until death [18]. In addition, morphology is an important science for plastic surgery and surgery has always progressed in the light of morphology throughout history [19]. In the surgical fields of dentistry, morphology follows anatomy with 5207 studies. It is obvious that morphology is a valuable branch of science not only for medicine but also for dentistry. The number of studies concerning the diagnosis and treatment modalities of maxilla facial fractures has significantly increased over the years [20].

Bibliometric analysis is a scientific method that researchers can use to glance at prominent areas of medical research and obtain an overview of the landscape of published literature [21]. Bibliometric studies are widely used in the field of information science, and enable researchers to make quantitative analyses of the academic literature [22]. Bibliometric techniques have been used in a wide variety of program evoluations including tracing research advances in cancer and the development of the

oral contraceptive [23]. When we examine the current status of studies on morphology using the bibliometric analysis method, it is seen that there has been an increase in the number of studies conducted in this field in the last 10 years and citations to the past in the following years. Especially the fact that the current state of the morphology department before the 2000s has changed compared to the post-2000s has reflected positively on the studies. This increase is seen not only in basic sciences but also in some departments of internal sciences. The number of publications written in the field of rheumatology in Türkiye is shown to have increased remarkably up until 2006 [24]. This increase is also seen when we look at surgical sciences. A bibliometric analysis allows for the identification of the number and quality of publications from a specific country. In general, Türkiye ranked 14th out of 122 countries in terms of the number of publications in the field of orthopedics and traumatology [25]. One of the reasons for this increase over the years is the increase in the number of academicians. Bahşi et al. [4] stated that the increase in the number of academicians as well as the increase in the number of medical faculties were effective in this increase.

Studies on morphology are carried out by many countries, especially the United States, China and Germany, and mostly in English. English, as the language of science, continues its dominance in this field. More articles belong to the document type of article and were written in English [26]. The documents from SSCI and SCIE databases via Web of Science and more than 99% of the articles were written in English [27]. The fact that the publications made in Turkish are 64 and ranked 6th shows the situation of our country.

Bibliometric analyses of the data were performed using VOSviewer software. This program is a professional software used to analyse and visualise bibliometric networks that help to understand trends in scientific research [28]. The figures and tables in our article were created with this system.

Network visualisation maps were created to show how much journals cite each other and the co-use of keywords and terms. In network visualisation maps, the thickness of the line between two elements reflects the strength of the relationship depending on the number of lines between the two elements. In fact, bibliometric analysis involves the application of mathematical and statistical methods to scientific publications [29].

In the future it will be important for scholarly disciplines to examine closely the literature as it represents the behavior of the scholars. Bibliometric analysis presents some empirical evidence that can be used in such an examination [30].

In conclusion, the science of morphology contributes to more studies in every field every year, and studies are carried out increasingly in many countries and universities. Morphology, which has shed light on other branches of science throughout history, needs to be studied more in our country.

Conflict of interest: No conflict of interest was declared by the authors.

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Authors' contributions to the article

D.A. has constructed the main idea and hypothesis of the study. G.T.I. and S.P.A. developed the theory and arranged/edited the material and method section. S.P.A. and F.T. have done the evaluation of the data in the Results section. Discussion section of the article was written by D.A., S.P.A. reviewed, corrected and approved. In addition, all authors discussed the entire study and approved the final version.