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CURRENT IMPACT OF THE MACEDONIAN ACADEMY OF SCIENCES AND ARTS IN THE SCOPUS DATABASE (2021 YEAR)

Abstract

Background: The mission of the Macedonian Academy of Sciences and Arts is to provide its full contribution to the inclusion of the state of Macedonian science and arts with regards to modern European and world-wide scientific trends. These crucial spheres of the human spirit and civilizational existence, reflected in the work of the Macedonian Academy of Sciences and Arts, are supported by the scientific and research work at the Academy and through its constant care for the preservation and affirmation of Macedonian artistic and cultural treasures and heritage. As these aspects are important premises for the overall development of the Republic of Macedonia. The vision of the Macedonian Academy of Sciences and Arts is to advance the Republic of Macedonia, thereby becoming a more advanced society, based on science and knowledge.

Aim: We aimed to investigate the current impact of the Macedonian Academy of Sciences and Arts has had in the Scopus database (2021).

Methods: On June 06, 2021**,** we performed an affiliation search of the Scopus database in order to identify published papers from the Macedonian Academy of Sciences and Arts (MASA) and from Ss Cyril and Methodius University, Skopje (UC&M), both located in the Republic of Macedonia.

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Results: We found 820 articles published by 120 authors, or 8.83 documents per author compared with 9927 articles with 3357 authors, or 3.36 documents per author published from those at the SS Cyril and Methodius University, Skopje. The majority the published works are scientific articles (81.2%) and the majority of the published documents are from the fields of physics and astronomy, medicine, as well as from biochemistry, genetics and molecular biology. The majority of publications is from Janev RK. The most frequent affiliation for these works is Macedonian Academy of Sciences and Arts. Based by country in the region, North Macedonia and Macedonia rank first place. The most frequent sponsor for the published papers is the Seventh Framework Programme. The first three authors ranked according to the Hirsh-Index are Janev Ratko K (h-index = 37), Kocarev L (h-index = 30), and Polenaković Momir H (h-index = 23).

Conclusions: There is a larger proportion of authors affiliated with the MASA (around 2.6 times more) than authors affiliated to the SS Cyril and Methodius University in Skopje who publish scientific papers.

Keywords: Macedonian Academy of Sciences and Arts; Ss Cyril and Methodius University, Skopje; Scopus database; Republic of Macedonia.

Introduction

The Macedonian Academy for Science and Arts (MASA) was established on February 23, 1967, by decree, proclaimed by the Law of the Macedonian Academy of Sciences and Arts (Statute No.18/67 from February 23, 1967) and the Assembly of the Socialist Republic of Macedonia and it later adopted the law regarding the Macedonian Academy of Sciences and Arts. Based on the law, a Register Committee was established, which was tasked with preparing the groundwork for the Macedonian Academy of Sciences and Arts. The election of the first 14 full members of MASA was completed on August 18, 1967 at the National Museum in Ohrid. The opening ceremony of the Macedonian Academy of Sciences and Arts was on October 10, 1967 in the Great Hall of the Assembly of the Republic of Macedonia. On that day, the Academy began its scientific and cultural activities, as mandated by the legal act for its establishment (1).

The Academy was established as the highest scientific and artistic institution in our country which monitors and stimulates the development of the sciences and the arts and strives for their advancement. The Academy surveys the situation of cultural heritage and natural resources, collaborates in preparing national policy regarding the sciences and the arts. The Academy also stimulates, coordinates, organizes, and conducts scientific research and artistic achievements, especially those particularly relevant to the Republic of Macedonia. In addition, the Academy facilitates the scientific and artistic work of its members and encourages the use of the most advanced methodologies, scientific knowledge, and results in the field of scientific research, and establishes, maintains. Finally the Academy also facilitates international cooperation in the fields of the sciences and arts (2).

As the highest independent scientific and artistic institution in the Republic of Macedonia, the Academy achieves its objectives by organizing basic, developmental, and applied research, with a focus on comprehensive and inter-disciplinary research. This is accomplished by organizing scientific meetings and artistic presentations and by publishing the results of said scientific research and scientific meetings and artistic works. The Academy collaborates with the universities, scientific and cultural institutions, scientific and artistic societies, and other organizations in the fields of the sciences and the arts throughout the Republic of Macedonia. It also collaborates with academies of sciences and arts and other scientific and artistic institutions abroad. After the Macedonian state was established at the First Antifascist Assembly of the People‘s Liberation of Macedonia (ASNOM) in 1944, 1967 was decided as the year of the official foundation of the Macedonian Academy of Sciences and Arts (2).

Candidates for the academicians prepares list of papers published in scientific journals with impact factor (IF), list of the papers published in other international and national journals, list of papers published in international foreign and national scientific conferences, as well as a list of prominent papers for the best presentation of the candidate (list of 10 the most important publications in international journals with impact factor) (3).

We aimed to investigate the current impact of the Macedonian Academy of Sciences and Arts in the Scopus database (2021).

Methods

The affiliation search of the Scopus database was performed on July 16, 2021. The goal was to identify published papers from the Macedonian Academy of Sciences and Arts (MASA) and from Ss Cyril and Methodius University, Skopje (UC&M), Republic of Macedonia.

Affiliation ID (AF-ID) of MASA is 60072633, but the affiliation ID of UC&M is not unique and contains 5 different affiliation identification numbers (Ss. Cyril and Methodius University, Faculty of Natural Sciences and Mathematics, Skopje, AF-ID 60072629; SS Cyril and Methodius University, Faculty of Medicine, Skopje, AF-ID 60072630; SS Cyril and Methodius University, Faculty of Pharmacy, Skopje, AF-ID 60072638; Clinic for Children's Diseases, Skopje, AF-ID60072628; and University Clinical Center, Skopje, AF-ID 60072639).

The articles selected for analysis date from 1989 until July 16, 2021. MASA provided a total number of 820 articles from 120 authors UC&M had 9927 articles with 3357 authors (Ss. Cyril and Methodius University, Faculty of Natural Sciences and Mathematics, Skopje, 7893 articles from 2389 authors; SS Cyril and Methodius University, Faculty of Medicine, Skopje, 1542 articles from 812 authors; SS Cyril and Methodius University, Faculty of Pharmacy, Skopje, 256 articles with 70 authors; Clinic for Children's Diseases, Skopje, 16 articles from 43 authors; and University Clinical Center, Skopje, 72 articles with 43 authors).

Results

The number of publications in the period from 1989-2005 was exceedingly small (1-20 papers per year). Starting in 2007, the number of published papers increased sharply with a maximum of 60 papers in 2011 (Fig. 1 upper). Most of the articles were published in the Balkan Journal of Medical Genetics (44 articles); Journal of Physics B Atomic Molecular and Optical Physics (37 articles); Physical Review A Atomic Molecular and Optical Physics (32 articles); Hemoglobin (29 articles); and Prilozi Makedonska Akademija Na Naukite I Umetnostite Oddelenie Za Bioloski I Medicinski Nauki - Contributions Macedonian (Academy Of Sciences And Arts Section of Biological And Medical Sciences) (18 articles) (Fig. 1 down).

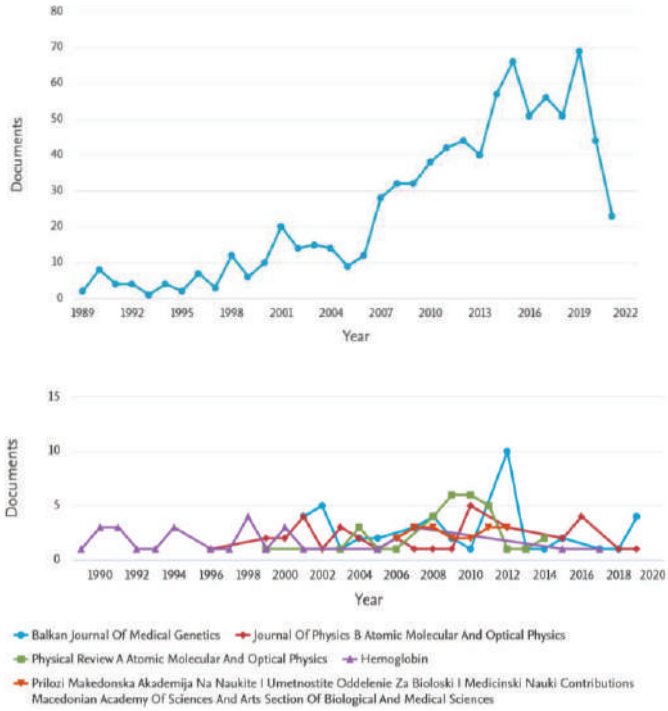


Figure 1 – Documents by year (upper) and documents per year by source (lower) published by the Macedonian Academy of Sciences and Arts included in the Scopus database from 1989 until July 16, 2021.

Most of the published papers are articles (81.2%), conference papers (9.4%), review articles (3.0%), and other types of articles (Fig. 2). The majority of the published documents are from Physics and Astronomy (252); Medicine (231); Biochemistry, Genetics and Molecular Biology (159); Engineering (95); Chemistry (88); Mathematics (73); Energy (49); Materials Science (45); Computer Science (44); and Agricultural and Biological Sciences (43). The rest of the subjects are presented in 15.7% (Fig. 2).

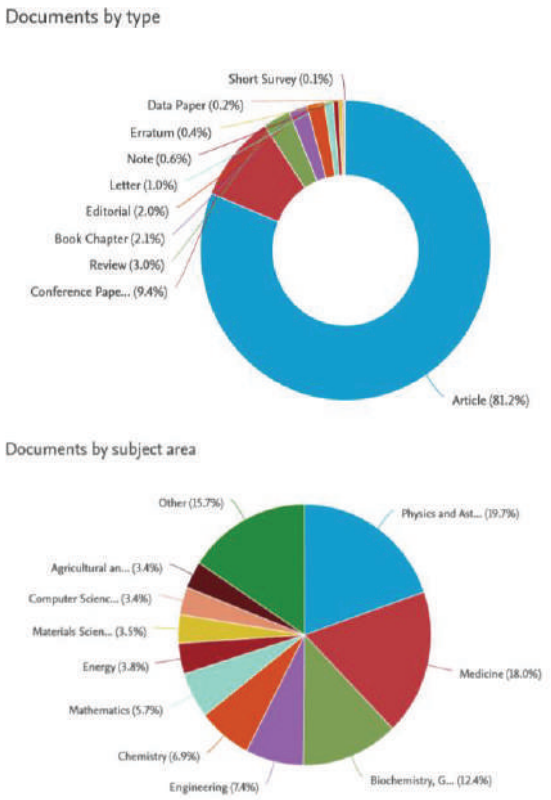


Figure 2 – Documents by type (upper) and documents by subject area (lower) published by the Macedonian Academy of Sciences and Arts included in the Scopus database from 1989 until July 16, 2021.

The most frequent publications are from Janev RK, Efremov GD, Plaseska-Karanfilska D, Kocarev L, Wang JG, Polenakovic M, Markovska N, Sandev T, Jovanovski G, and Liu L (Fig. 3a). Documents by the 10 most frequent affiliations are from the Macedonian Academy of Sciences and Arts (820), SS Cyril and Methodius University (327), Beijing Institute of Applied Physics and Computational Mathematics (77), SS Cyril and Methodius University, Faculty of Medicine (76), Institute of Chemistry, SS Cyril and Methodius University 74), University of California, San Diego (61), Forschungszentrum Jülich FZJ (42), Columbia University (40), University of Belgrade (33), and BioCircuits Institute (32) (Fig. 3b). Based on country or territory, North Macedonia (635) and Macedonia (173) are on first place followed by United States (161), Germany (133), China (93), Italy (69), Bulgaria (53),

Serbia (50), United Kingdom (50), and Croatia (44) (Fig. 3c). The most frequent sponsors for the published papers from the MASA are Seventh Framework Programme (35), National Institute of Mental Health (32), National Natural Science Foundation of China (30), Deutsche Forschungsgemeinschaft (25), National Institutes of Health (25), European Commission (20), Alexander von Humboldt-Stiftung (16), National Key Research and Development Program of China (13), Canadian Institutes of Health Research (11), and Horizon 2020 Framework Programme (11) (Fig. 3d).

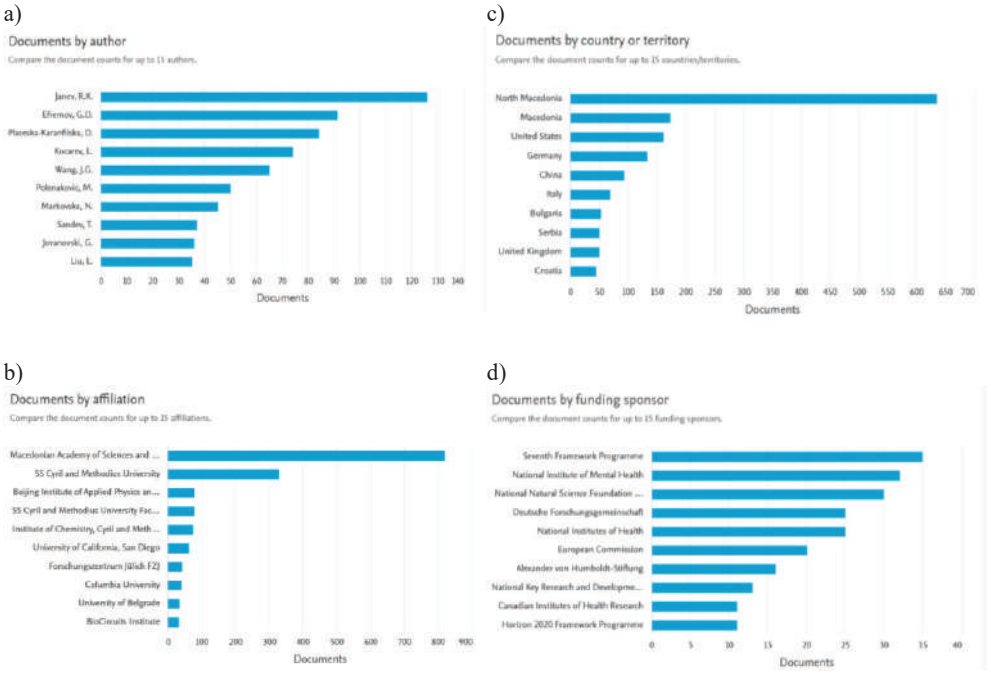
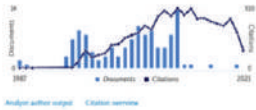
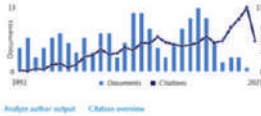
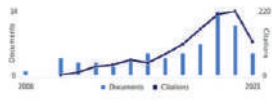


Figure 3 – Documents by author (a), documents by affiliation (b), documents by country or territory (c), and documents by sponsor (d) published by the Macedonian Academy of Sciences and Arts included in the Scopus database from 1989 until July 16, 2021.

Figure 4 displays the analysis of the articles of the first 10 authors published from the Macedonian Academy of Sciences and Arts which are included in the Scopus database from 1989 until June 06, 2021 ranked according to the Hirsh-Index. First three authors are Janev Ratko K (h-index = 37), Kocarev L (h-index = 30), and Polenaković Momir H (h-index = 23). The rest of the academics have an h-index of 20, 16, 15, 14, and 13, respectively. Documents per author range from 299 (Janev Ratko K) to 16

(Ristov M). The number of citations is 5264 to 593 and is not equally distributed from the first to the tenth place. Citation trends are very heterogenous among the first ten academicians (Fig. 4)

Author Scopus Author ID:	Document & citation trends	Documents by author	Citations	h-Index
1. Janev, Ratko K. 7007174243		299	5264	37
2. Kocarev, L. 7005782701		122	4978	30
3. Polenaković, Momir H. 8122907000		194	1862	23
4. Sandev, Trifce 36619822900		68	1056	20
5. Stefov, Viktor 6601978749		62	775	16
6. Grčev, Leonid D. 55952986500		64	1660	15

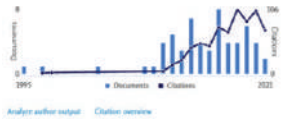
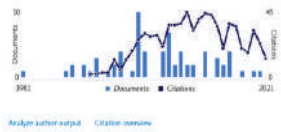
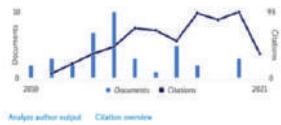
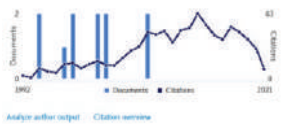
7. Markovska, Nataša 22994164800		59	693	15
8. Popov, Zivko 7004730664		69	736	15
9. Bačeva Andonovska, Katerina 57115361000		38	593	14
10. Ristov, M. 6601912303		16	846	13

Figure 4 – Analysis of the articles from the first 10 authors published by the Macedonian Academy of Sciences and Arts included in the Scopus database from 1989 until July 16, 2021.

Table 1 compares published papers from MASA and UC&M in the Scopus database. We can see that authors from MASA published 820 papers in the period of 1989-2021 which are included in the Scopus database. The 120 authors have an average of 8.83 documents per author. Comparatively, Ss. Cyril and Methodius University, Faculty of Natural Sciences and Mathematics, Skopje published 7893 articles with 2389 authors with an average 3.30 documents per author. SS Cyril and Methodius University, Faculty of Medicine, Skopje published 1542 articles with 812 authors o6 1.90 documents per author. SS Cyril and Methodius University, Faculty of Pharmacy, Skopje published 256 articles from 70 authors with 3,65 document/author, Clinic for Children's Diseases, Skopje published 164 articles from 43 authors

with an average 3.81 documents per author. Finally, the University Clinical Center, Skopje published 72 articles from 43 authors with an average of 1.67 documents per author. The cumulative Results for all Affiliations from SS Cyril and Methodius University, Skopje reveal 9927 published articles from 3357 (authors?) with an average 3.36 documents per author (Table 1).

Table 1
Comparison of the published papers from MASA and UC&M in the Scopus database

Affiliation	Affiliation ID	No of Documents	No of Authors	Documents/ author
Macedonian Academy for Sciences and Arts, Skopje (MASA)	60072633	820	120	8.83
Ss. Cyril and Methodius University, Faculty of Natural Sciences and Mathematics, Skopje	60072629	7893	2389	3.30
SS Cyril and Methodius University, Faculty of Medicine, Skopje	60072630	1542	812	1.90
SS Cyril and Methodius University, Faculty of Pharmacy, Skopje	60072638	256	70	3.65
Clinic for Children's Diseases, Skopje	60072628	164	43	3.81
University Clinical Center, Skopje	60072639	72	43	1.67
Cumulative Results for all Affiliations from SS Cyril and Methodius University, Skopje (UC&M)	Should be officially corrected	9927	3357	3.36

Discussion

In this paper we conducted the initial analysis of the published papers from the Macedonian Academy of Sciences and Arts in Skopje from 1989 until July 16, 2021 via the Scopus database. We found 820 articles published form 120 authors affiliated with MASA, or 8.83 documents per author compared to 9927 articles with 3357 authors, or 3.36 documents per author published from the SS Cyril and Methodius University, Skopje. This suggests a higher level of publishing productivity among the authors affiliated with MASA (around 2.6 times more productive) than authors from SS Cyril and Methodius University in Skopje. Affiliation ID of SS Cyril and Methodius University, Skopje is not complete, but is distributed among the five affiliations. This should be officially corrected. A similar situation was discussed in 2014, in the plans for the structure of SS Cyril and Methodius, Skopje. The problem, however, was not solved, and this is still present in the Scopus database, and thus could negatively influence the Institutional ranking of the SC&M University (4).

The majority of the published papers from the authors affiliated with MASA are scientific articles (81.2%) and the biggest number of the published documents are from the fields of physics and astronomy, medicine, as well as from biochemistry, genetics and molecular biology. The most prolific publisher is Janev RK, and the most frequent affiliation is the Macedonian Academy of Sciences and Arts. Based on country or territory, North Macedonia and Macedonia are first place. The most frequent sponsor for the published papers is Seventh Framework Programme. The first three authors, ranked according to the Hirsh-Index, are Janev Ratko K (h-index = 37), Kocarev L (h-index = 30), and Polenaković Momir H (h-index = 23).

The results of the scientific journals indexed in Scopus from IX Section of the Hungarian Academy of Sciences show that 80 percent of the journals have their own website, half of them are published on time. One fifth have an archiving policy and one tenth have a code of ethics. On average, 42 months have passed since the publication of the most recent issue. These indicators depend on the quality categories, and there is a significant correlation between the category, the number of papers and the number of citations per paper [5].

A comparison of the average h-index of members of the Brazilian Academy of Sciences (BAS) and of the National Academy of Sciences of the USA (NAS-USA) was carried out for 10 different areas of science. The comparison, however, was unfavorable towards the members of the BAS; the imbalance was distinct in different areas. Since these two academies represent, to a significant extent, top quality science produced in each country, the comparison allows the identification of the areas in Brazil that are closer to the international participants of scientific excellence. The areas of physics and mathematics are of particular interest. The heterogeneity of the h-index in the different areas, estimated by the median dispersion of the index, is significantly higher in the BAS than in the NAS-USA [6].

Details for the journals with an Impact Factor (IF) and journals listed in the Scopus (SJR, Q number) are mandatory mostly in the scientific fields of natural sciences, biotechnical, technical, and medical sciences and partly for social and humanitarian sciences. These help to focus on national questions and national strategies published mostly in national journals and monographs which are equally important but not present in the indexed journals.

Several papers are published in the Republic of Macedonia using the Scopus database and other resources connected to it (4-7). The SCImago database was used for the analysis of country rank, journal rank and H-index in the Republic of Macedonia and other former Yugoslav countries (Slovenia, Croatia, Serbia, Bosnia and Herzegovina, and Montenegro) for the period of 1996-2008, as they are presented in the Scopus database. Of a total number of 222 countries for the period of 1996-2008, the Republic of Macedonia, with an H-index of 20, is placed at 118th position, the percentage of citable documents in the field of medicine is 88.92%, and the percentage of relative production of documents in the world is below 0.01. In 2008, the Macedonian biomedical journal Prilozi was ranked 2484th with 0.048 SJR citable documents in the last three years. The field of nephrology in Macedonia had the highest H-index of 10 for the period between 2007 and 2008, this is followed by medicine (miscellaneous), with H-index of 7; hematology and endocrinology, diabetes and metabolism, with H-index of 6; and finally, transplantation, oncology and pathology, and forensic medicine, with H-index of 5. There is only one Macedonian biomedical journal (Prilozi, Macedonian Academy of Sciences and Arts, Section of Biological and Medical Sciences) included in the Scopus database for the period between 1996 and 2008. This might be due

to error, as it is listed among the journals as being from Serbia, instead of from the Republic of Macedonia. The primary task of the Editorial Boards of other Macedonian medical journals is to include their journals in the Scopus database (7).

We also performed an analysis of h-index for the full members of the Brazilian Academy of Sciences (BAS). We then determined the h-index of 402 members listed in 10 distinct categories by the BAS, cross-checked with the curriculum vitae of each of the members listed on the Plataforma Lattes database (CVL), and then compared these with each other. Despite the large production, mostly in journals without an impact factor, the h-indexes among the BAS members are comparatively low and show a large variation in all of the 10 categories, particularly in biomedical and physical sciences. The highest average of h-index values was found in biomedical, health and chemical sciences; the lowest values were found in human sciences where this index is meaningless (8).

A search of the Scopus database was performed on February 23, 2013 in order to identify published papers from the field of medical sciences affiliated with Macedonia. A total number of 967 articles were selected for analysis and the h-index was calculated for these documents. The papers were published in a total of 160 journals. The largest number of papers were published in domestic journals. The published papers have been cited 4380 times (mean citation of 4.5 per paper) with a Hirsh index (h-index) value of 27 (9).

An affiliation search of the Scopus database was performed on November 23, 2014 in order to identify published papers from the Ss Cyril and Methodius University of Skopje (UC&M), Republic of Macedonia. A total number of 3960 articles were selected for analysis (1960-2014). The largest number of papers were published in the Macedonian Journal of Medical Sciences, Journal of Molecular Structure, Lecture Notes in Computer Science, Acta Pharmecutica, and Macedonian Journal of Chemistry and Chemical Engineering. The first three places at the top ten authors belong to Dimirovski GM, Gavrilovska L, and Gusev M. Top three places based on the Scopus h-index (total number of published papers) belong to Kocarev L, Stafilov T, and Polenakovic M. Most papers originate from UC&M, but a significant number of papers are affiliated with the Faculty of Medicine, Faculty of Pharmacy, and Institute of Chemistry as members of UC&M, as well as the Macedonian Academy of Sciences and Arts. Articles

are the most dominant type of documents followed by conference papers, and review articles. Medicine is the most represented subject (4).

The country rankings of Macedonia were analyzed with SCImago Country & Journal Rank (SJR) for subject area of medicine in the years of 1996-2013 and then ordered by H-index value. Medicine in the Republic of Macedonia, according to the SCImago Journal & Country Rank (SJR), is 110th in the world, and 17th in Eastern Europe. Of the 20 universities in Macedonia, only Ss Cyril and Methodius University, Skopje, and the University St. Clement of Ohrid, Bitola, are listed in the SCImago Institutions Rankings (SIR) for 2013. An exceedingly small number of Macedonian scholarly journals is included in the Web of Sciences (2), PubMed (1), PubMed Central (1), SCOPUS (6), SCImago (6), and Google Scholar metrics (6). The Hirsh index (h-index) ranking was different from the rank of number of abstracts indexed in PubMed for the top 20 authors from Macedonia (10).

The analysis in Bosnia and Herzegovina showed a significant correlation between the Academy and the country of origin of the academician. AMNuBiH and ANUBiH mainly represent academics from Bosnia and Herzegovina, while in ANURS 71.4% of the members are academics with a background from Serbia. There is no significant correlation between the observed parameters (Scopus parameters–number of papers, H-index, number of citations) according to membership in Academies. By analyzing the correlation between the country of residence, the number of papers, H-index and the number of citations, the correlation appears significant between the state and the number of papers, but not significant in the other two observed parameters. We concluded that criteria for admission into the main academic communities are highly questionable. Progress in the academic hierarchy must be more stringent, and the criteria must be set to the highest possible level, as this is the only path which leads to progress (11).

The African Academy of Sciences (AAS) is the preeminent science academy on the African continent. The study investigated the bibliometric parameters of the AAS medical and health sciences fellows was published (12). The demographic information of the 80 medical and health sciences fellows were obtained from the AAS website. Subsequently, the bibliometric information (total number of publications, H-index scores, citation, and co-authorship counts) were extracted from the Scopus database. Most of

the fellows were from the Eastern (36%) and Western (33%) African regions; the Northern (6%) and Central (4%) regions were vastly underrepresented. Although only 34% of the AAS fellows were women, there was no statistically significant difference in the bibliometric parameters for both genders. The year of induction as a fellow and region of employment in Africa significantly influenced the bibliometric parameters. The fellows from the West African region had the highest number of publications, citations, and co-authorship count, and the South African fellows had the highest H-index score. The data presented provide insight into the biblio-metric productivity of African scientists compared with their peers from other science academies around the world. Similarly, the data may assist burgeoning scientists aspiring to be an AAS fellow in setting realistic goals toward achieving the stipulated H-index benchmarks (12).

Determination of the current state of international scientific cooperation in the context of the scholarly research periodicals of the National Academy of Sciences of Ukraine in the world of scientometric databases was published. The information framework of the research includes the legislative acts, resolutions of the Cabinet of Ministers of Ukraine, and the orders of the Ministry of Education and Science of Ukraine. This analysis included paper versions of the journals of the National Academy of Sciences of Ukraine and their websites, scholarly research periodicals of Ukraine by the Vernadsky National Library of Ukraine, Web of Science, SCOPUS, Google Scholar, Index Copernicus, Open Access Journals (DOAJ), and ERIH PLUS. The introduction of scholarly research periodicals to the international abstract and scientometric databases and their actual state has been described. The introduction of information technology, access to databases and the stimulation of their development of magazines open up ways to increase (intensify) international scientific cooperation in the scientific domain by broadening the presentation of the results of research activity in scholarly research periodicals (13).

We have to say that the academics working in the fields of literature, arts, and music are examined differently with other quality indexes and cannot therefore be compared with the identical indexes of other fields.

There are several limitations of this investigation. There are several authors included with affiliation in the Macedonian Academy of Sciences and Arts, but they work outside of the academy. Affiliation in the Macedo-

nian Academy of Sciences and Arts is for the academics as well for scientific collaborators in different centers of the Macedonian Academy of Sciences and Arts. Thus, all results are cumulative from all academics plus their collaborators, not only from the academics. In the future, a differentiation between the academics and other employees at the Macedonian Academy of Sciences and Arts should be made, an investigation of other databases, as well as a comparison with other similar institutions.

In conclusion, we can say that there is more academic publishing productivity on behalf of the authors affiliated with MASA (around 2.6 times) than by authors affiliated with SS Cyril and Methodius University in Skopje.

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