

## REPORT

on the materials presented for participation in the competition for the academic post of "Professor" in *Technical sciences*, professional field 5.11. *Biotechnology (Technology of biologically active substances)* announced for the needs of Laboratory of Metabolomics, Department of Biotechnology, Stephan Angeloff Institute of Microbiology - Bulgarian Academy of Sciences (IMB - BAS)

Reviewer: Prof. Ilza Konstantinova Pajeva, DSci, PhD  
Institute of Biophysics and Biomedical Engineering – Bulgarian Academy of Sciences

The only candidate in the competition for "Professor" announced in the State Gazette, issue 47 of 22 May 2020 and on the website of IMB–BAS (<http://microbio.bas.bg/wordpress/index.php/karieri/akademichna-dlazhnost-profesor/institutat-po-mikrobiologiya-stefan-angelov-kam-ban-obyavyava-chetiri-konkursa-za-profesor/>) (<http://biomed.bas.bg/bg/procedures/concourse-professor-qsar/>), is **Assoc. Prof. Dr. Milen Ivanov Georgiev** from the same institute.

### 1. GENERAL PRESENTATION OF THE PROCEDURE AND THE APPLICANT

In the competition all documents and materials needed to fulfill the requirements for the academic post "Professor" are presented in accordance with the Act for the Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Regulations for the Implementation of ADASRB, the Regulations for the Implementation of ADASRB of BAS and the specific Regulations of IMB-BAS.

The candidate's biographical record demonstrates an ascending scientific development and rich academic experience gained in renowned Bulgarian and international research institutes with leading positions in the professional field of the competition. His main research results have been obtained at IMB–BAS; they are closely related to the scientific topics of the institute thus suggesting future benefits from his election as a "Professor" for the research staff of the Laboratory of Metabolomics and IMB.

In the competition for "Professor" Assoc. Prof. Dr. M. Georgiev has presented **57 scientific papers** published in the period 2009-2020, all on the topic of the competition, which are outside his PhD thesis and his "Associate Professor" competition. Of these, **54 are articles published in peer-reviewed and indexed scientific journals with impact factor (IF) and 3 are book chapters** published by the scientific publishers *Elsevier* and *Springer*. The articles are divided into categories (quartiles, Q) as follows: 40 are in Q1, 11 - in Q2, 1 - in Q3 and 2 - in Q4. According to indicator B, 28 articles are indicated (639 points), and according to indicator D - 26 articles and 3 book chapters (665 points). In 26 of these publications the candidate is a leading and/or corresponding author. The *Reference for fulfillment of the minimum requirements* points to **1057 citations** of his works according to Scopus and Web of Science (as of 14.7.2020), for which a complete bibliography is presented. A full list of management (5) and participations (6) in national and international educational and scientific projects are also reported with attracted funds for projects managed by the applicant, **amounting to BGN 6,77 million**. The candidate exceeds significantly the minimum requirements of the IMB' regulations for the academic position "Professor" in terms of number of publications and the role in the author's team, number of citations, Hirsch index ( $H = 25$ , 10 is required) and number of projects managed.

Data are also presented for 3 doctoral students, led by Assoc. Prof. Georgiev, one of them with the right to defense after expiration of the PhD period. The reference to the publications shows that this PhD student is a co-author of the candidate in 4 articles (numbers 33, 42, 43 and 72 in the list of publications), and in 2 of them (42 and 43) he is a first author. These publications are distinguished by original scientific and methodological results related to a systematic, first-of-its-kind study of dwarf elder plant. This gives me reason to believe that Assoc. Prof. Georgiev has done the most important part of his work as a PhD supervisor, and the real defense of the PhD thesis is a matter of time and personal organization of the doctoral student. Another of the doctoral students has 2 publications (in one of them as a leading author), which demonstrates that the student is guided to the successful completion of the doctoral studies, scheduled for 2021. I would like to add that the candidate has also been a supervisor of 14 diploma students and fellows, incl. foreign ones. All these facts testify that Assoc. Prof. Georgiev has demonstrated his abilities as a scientific supervisor, which, I believe, covers the additional requirements of the specific Regulations of IMB – BAS.

With the data on all indicators Assoc. Prof. M. Georgiev collects **a total of 5072 points**, which is **more than 8 times above the minimum requirements** for the academic position "Professor" set by ADASRB, the Regulations for its implementation, the Regulations of BAS and the Regulations of IMB - BAS for holding this academic position.

## **2. GENERAL CHARACTERISTICS OF THE APPLICANT'S ACTIVITY**

**Contributions.** I agree with the scientific contributions in *Habilitation Extended Report* and *Brief Information about the Research Work* given by Assoc. Prof. M. Georgiev. He formulates 7 main contributions, based on the scientific papers on the competition. By subject, these contributions fall into the three interrelated scientific fields as mentioned in *Habilitation Extended Report*, namely plant biotechnology, chemistry of natural molecules (including metabolomics and metabolic profiling) and pharmacology. The ultimate goal of the candidate's research is to discover new pharmaceutically important molecules, based on investigations of the mechanisms of their formation in plant cells and the development of modern biotechnological approaches for their sustainable production. The results of Assoc. Prof. Georgiev confirm the achievement of this goal.

**In general, the contributions can be summarized as follows** (the numbers given in brackets are only of articles reporting original research results):

1. Creating a basis for obtaining a comprehensive knowledge of secondary metabolism in plant cells and its manipulation at molecular and genetic levels (5, 10, 12, 13, 20, 23, 25, 28, 31, 34, 42, 43, 50, 52, 53, 55 according to the list of publications).
2. Phytochemical screening, detection of new biologically active substances of plant origin, their purification and characterization (publications 5, 12, 23, 25, 33, 34, 38, 42, 43, 52).
3. Discovery and elucidation of mechanisms of biological effects of natural compounds of plant origin - extracts and individual molecules (publications 10, 15, 17, 19, 20, 21, 23, 25, 27, 29, 32, 35, 37, 54, 56).
4. Development of new plant-based materials (publication 29).

The contributions listed above are closely related and the results they are based on are often simultaneously reported in the publications. A special attention should be paid to **Assoc. Prof. Georgiev's contribution to the development of a reliable analytical platform utilizing NMR-based metabolomics** and using various analytical (e.g. gas- and liquid chromatography) and mathematical methods (eg. principal component and cluster analyses) to analyze metabolomic

fingerprinting of plant extracts. **Assoc. Prof. Georgiev is a pioneer in the field of NMR-based metabolomics** in our country, in fact **he was the first to introduce it in Bulgaria**, opening the way for identifying and obtaining structural information for a wide range of compounds with high analytical accuracy. The platform allows conducting research at a qualitatively new level, which in addition to the opportunity to gain fundamental knowledge in the field of plant systems biology, has the potential for practical application. Evidence of these possibilities are the results of the candidate in phytochemical screening of medicinal plants, incl. Bulgarian endemic species from natural habitats, quality control of plant products, comparison of metabolic differences between plants and the corresponding *in vitro* cultures.

I consider **the main contributions of the candidate, which most clearly outline his personal academic profile, as achievements in the field of plant systems biology and metabolomics**. The contributions are mainly of **scientific and methodological nature** and the established methodological basis for a complex analysis of biochemical processes related to secondary metabolism in plant cells has already been proven for its **wide practical application**.

In the presented materials the candidate outlines guidelines for his future research work, as a continuation and upgrade of the achievements so far, which once again confirms the potential benefits of his election as a "Professor".

**Scientific metrics.** Assoc. Prof. M. Georgiev has presented 29 original research articles and 28 scientific reviews, of them 2 editorials. The review articles are characterized by an in-depth analysis of the results on the topic of the review, based mainly on the own results of the author's team. In this sense, the reviews also have an important role in outlining the candidate's contributions. The large number of reviews is recognition of the experience and knowledge gained by the candidate and his co-authors to be shared with the professional scientific community. All articles in the competition are published in specialized scientific journals, referenced and indexed in the world-renowned scientific databases Web of Science and Scopus. **Of the 57 titles, 95% were published in IF journals with a total sum of impact factors of 247,106.** Among them are review articles published in *Trends in Biotechnology* (IF=14.343 for 2019), *Trends in Plant Science* (IF=14.416 for 2019), *Biotechnology Advances* (IF=10.744 for 2019), *Critical Reviews in Biotechnology*=8.108 for 2019) etc. Journals in which the candidate publishes his original research articles are also with high IF, e.g, *Journal of Experimental Botany* (IF=5.36 for 2019), *Food and Chemical Toxicology* (IF=4.679 for 2019), *Phytomedicine* (IF=4.268 for 2019), *Biomolecules* (IF=4.082 for 2019) etc. **The large number of publications and the high IF of the journals they appear in the last years** are impressive. **Of the scientific papers, 70% fall into the Q1 category**, which is an indicator of the high quality of the reported scientific results. This is confirmed by the data on the large number of citations (over 2500) and the high value of the H-index of Assoc. Prof. Georgiev. These results show the candidate's intention **to maintain a consistently high level of publication activity and high quality of his publications**. They also testify **to the international recognition of its results by the scientific community**.

**Additional notes.** As a participant and a member of the Program Committees of the international scientific conferences "ICNPU" organized by Assoc. Prof. Georgiev in the recent years I have excellent personal impressions of him. With each subsequent conference, the number of participants and the quality of scientific reports and posters increased, making ICNPU one of the world's most prestigious scientific forums on natural products utilization. The materials presented at this competition not only confirmed my positive impressions so far, but convinced me that Assoc. Prof. M. Georgiev is a great scientist, who develops and supports a wide network of international scientific contacts (joint research with colleagues from more than 30 countries)

and collaborations with a number of national academic institutions (8 centers and universities in Bulgaria). His research, expertise, management and organizational achievements have received recognition - for them he has been awarded a number of prestigious awards, including “Pitagor awards” (three times) and two BAS awards. The Bulgarian academic community can be proud of his achievements.

I would like to mention also the excellent structuring, the clear and concise presentation of the materials on the competition, which greatly facilitated my work on the Report.

### 3. CONCLUSION

The documents and materials presented by Assoc. Prof. Dr. Milen Georgiev in this competition meet the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Regulations for the Implementation of ADASRB, the Regulations for the Implementation of ADASRB of BAS and the specific Regulations of IMB-BAS.

The candidate has submitted a large number of scientific papers published after the defense of his PhD thesis and the competition for the academic post “Associate Professor”. The points collected on the indicators significantly exceed the minimum required by generally accepted criteria. In this way, the results achieved by him fully comply with the requirements for holding the academic position "Professor".

Assoc. Prof. Dr. M. Georgiev has obtained original scientific results that have been published in renowned scientific journals with high impact factors, which have given them national and international recognition. In most of the publications he has a leading position and outlined personal contribution to the obtained results, which defines him as a scientist with an clearly outlined own academic profile.

The above gives me a **reason to assess positively the candidate’s achievements and to strongly recommend** the Scientific Jury to prepare a report-proposal to the Scientific Board of IMB-BAS for **the election of Assoc. Prof. Dr. Milen Ivanov Georgiev as a Professor** in the professional field 5.11. *Biotechnology (Technology of biologically active substances)* at Stephan Angeloff Institute of Microbiology - Bulgarian Academy of Sciences.

15 Sep 2020

.....  
Prof. Ilza Pajeva, DSci