

Review

PRESENTED by Prof. Dr. Dimitar Stefanov Kadiysky, MD, PhD,

from the Institute of Experimental Morphology, Pathology and Anthropology with Museum (IEMPAM) at the Bulgarian Academy of Sciences,

elected as a member of the Scientific Jury and reviewer on the basis of order No. 1-98/05-07-2022 of the Director of the Institute of Microbiology "Stefan Angelov" at the Bulgarian Academy of Sciences (IMicB- BAS), Prof. Dr. Penka Petrova, on the proposal of the Scientific Council, Council of the Institute, protocol No. 32 of 26.05.2022.

REGARDING the competition for the academic position of "Professor" in the scientific specialty "Microbiology" in the professional direction 4.3.Biological Sciences, for the needs of the Department "Biotechnology", Laboratory "Bioremediation and Biofuels" at IMicB - BAS, with a single candidate Assoc. prof. d-r Lyudmila Vladimirova Kabaivanova from the same Institute.

I. Analysis of the career profile of Assoc. Dr. Ludmila Vladimirova Kabaivanova

Assoc. Dr. Ludmila Kabaivanova graduated in 1992 from Sofia University "St. Kliment Ohridski", Faculty of Biology majoring in "Biochemistry and Microbiology" as a master's degree.

After completing her higher education in the period until 2006, associate professor Kabaivanova developed a dissertation on the topic "*Degradation of nitrile compounds with Bacillus sp.-UG-5B cells immobilized in different carriers, producer of thermostable nitrilase*", defended successfully in IMicB - BAS. There, in 2011, she won a competition for the academic position of "associate professor", and for the period from 2016 to 2020, she was elected as scientific secretary of the institute. During the same period, Prof. Kabaivanova was the head of the "Applied microbiology" department. To date, she heads the "Biotechnology" department and the "Bioremediation and biofuels" laboratory, while at the same time she is the deputy director of the "Stefan Angelov" Institute of Microbiology at the BAS.

The successive career growth of the candidate, including the positions of specialist microbiologist from 1993 to 1996, chief assistant 1996-2011 and associate professor after that, is a natural result of intensive research and teaching (graduate students, doctoral students, courses at the Training Center, etc.) activity of the candidate.

II. Presented materials for the competition

Associate Professor Lyudmila Kabaivanova presents 115 scientific papers with a total IF of 55,554.

In 66 of them, she is the lead author. Her known citations to date are 450, and the established h-index is 12.

Documentation has been provided that shows the active participation of associate professor Kabaivanova in 69 scientific forums, most of them participation in major scientific events abroad.

Participated in the implementation of 19 national and international research projects, attracting many funds for their implementation to the activity of the institute. In three of them, she is the project manager.

The candidate has submitted a complete electronic set of the required documents for participation in the announced competition. Some of them are of an administrative nature: application for participation in the competition; creative resume – European format; diploma of completed higher education; diploma for acquired educational and scientific degree "doctor"; diploma for an acquired academic position "associate professor"; a certificate of seniority and a reference to the academic positions held to date. The remaining documents directly related to scientific growth: lists of scientific publications (including from scientific forums); list of participations in national and international scientific projects; citation reference; report on the impact factor; summaries, reference for scientific supervision of doctoral students and graduate students, reference for the contributions of scientific works; copies of scientific publications in full text and other documentation are presented in a form that allows the tracking of scientific growth before and after the candidate's habilitation (2011). The necessary documents are available, certifying the coverage and in many cases exceeding the indicators specified in the *Academic staff development law* (ASDL) and its Regulations, incl. in the Regulations of IMicB for occupying the academic position "professor". This volume of documents for the competition is in full compliance with the minimum required for participation in the announced competition.

III. Evaluation of the scientific activity of the candidate

During all the years of work in the field of microbiological science, assoc. prof. Kabaivanova established herself as an outstanding specialist who skillfully handles a large set of biotechnological, biochemical, morphological and research approaches related to nanotechnology and ecology. Before proceeding to the specific evaluation of the scientific works of associate professor Kabaivanova, I will allow myself to point out that the significant part of them are co-authored with distinguished scientists, which emphasizes her skill, attitude and ability to work in a scientific research team, without which modern science today is unthinkable.

All scientific publications up to 2011, submitted according to the list and related to the candidate's habilitation in the competition for associate professor, together with the resulting scientific contributions, were peer-reviewed during her habilitation. I accept them without objection and basically I will not evaluate them.

My approach will be similar to the publications related to her dissertation work, incl. the abstract - they are not the subject of my review, but will be taken into account in my overall evaluation of the scientific research activity of assoc. prof. Kabaivanova. The evaluation of the scientific works of the candidate, published after acquiring the academic title of "associate professor", is essential for the current competition.

The presented scientific works of the candidate are 115. In the current competition, the publications of L. Kabaivanova are distributed according to the following principle: according to indicator A - Abstract - 1 no. - for obtaining the educational and scientific degree "Doctor", List B includes 6

scientific publications (3xQ2, 2xQ3 and 1xQ4), and List D - 15 scientific publications (1xQ1, 11xQ3 and 3xQ4).

In general, this publication array of Dr. Lyudmila Kabaivanova can be divided into several scientific directions: **aerobic biodegradation processes**, [Publication B – 2, Publication C – 3, Publication C – 6], Publication D – 3, Publication D – 4, Publication D – 5, Publication D - 6]; **anaerobic biodegradation processes** concerning the utilization of various wastes in order to obtain renewable energy carriers [Publication C – 1, Publication D – 11, Publication D – 12, Publication D – 13, Publication D – 15]; publication of results of research activities related to **waste products and plant residues** from agricultural practice and using the activities of bacteria and fungi in biodegradation processes [Publication D – 10, Publication D – 14]; **microalgae** - food and therapeutic applications, obtaining new biologically active substances from algae in order to test their potential as antitumor agents for use in biomedicine [Publication B – 4, Publication B – 5, Publication D – 1, Publication D – 7, Publication D – 8]; obtaining new **biologically active substances** from bacteria, applicable as an alternative to conventional medicines. [Publication D – 9, Publication D – 2].

In the context of the assessment made above, I would like to point out that assoc. prof. Kabaivanova meets the standard requirements of ASDL for awarding the academic degree "Professor". Its indicators of scientific growth are also higher compared to the specific *ADDITIONAL CRITERIA FOR THE GROWTH OF THE ACADEMIC STAFF in IMIKB*, which can be seen from the attached reference.

Additional requirements

Professor 20 publications (after "associate professor") in 16 of them leading or corresponding 400 citations, IF 40, H-index 10, Management of 3 projects and 2 suspended doctoral students

Associate Professor Dr. Kabaivanova 21 (after "associate professor") in 19 of them lead or corresponding author, 450 citations, IF 55,554, H-index 12, 3 projects – supervisor, 1 defended doctoral student+1 doctoral student, defended on 29.09.2022.

I could say the following about the **qualities** of assoc. prof. Kabaivanova's scientific production submitted in the competition:

A quick review of the methods used in the candidate's publications convinces us of a skillful combination of conventional and classical with modern experimental approaches. Their diversity is formed by microbiological and biotechnological procedures, biochemical isolation techniques, biodegradation methods for *in vitro* cultivation of various strains, nanotechnological procedures, artificial acceleration of the bioproduction of bacteria and fungi, immunochemistry, morphology and modern screening of the obtained results incl. by the demonstrative scanning electron microscopy.

After the review, which I made quite schematically, I would group the scientific contributions of associate professor Kabaivanova in the following main directions, which in practice represent a derivative of the directions of the candidate's research activity.

A significant part of the contributions derive from the study of aerobic biodegradation processes with an emphasis on the detoxification abilities of microorganisms and the study of the optimal conditions for biodegradation and biosorption. They are applicable to solving a number of environmental problems.

Other scientific and practical contributions were formed after studying anaerobic biodegradation processes with the participation of specific microbial communities and concern the absorption of various wastes in order to obtain renewable energy carriers - an alternative to fossil fuels.

Contributions and scientific conclusions resulting from experimentation on waste products and plant residues from agricultural practice by using the activities of bacteria and fungi in biodegradation processes and creating nutrient-rich composts applied will contribute to more sustainable agriculture and clean food and directly fall in the field of environmental problems.

The study of microalgae by associate professor L. Kabaivanova and the preparation of new biologically active substances, the testing of their potential as antitumor agents are contributions with application in biomedicine.

Contributions that are re-directed to biomedicine and therapeutic approaches stem from the candidate's research work on obtaining new biologically active substances from bacteria and testing their action on certain cancer cell lines. There is a potential application of these substances as an additional alternative to conventional medications.

Considering that the candidate's original microbiological scientific-practical contributions are related to biomedicine and ecology (the problems of environmental pollution and the development of technologies involving microorganisms for cleaning), the immediate connection of the results of assoc. prof. Kabaivanova's research activity with health becomes clear of man and the protection of his habitat on our planet..

The general concept of using the capabilities of microorganisms for bioremediation of contaminated environments, the subject of a significant part of the candidate's research, is a widely accepted strategy in science and practice because of its effectiveness.

As a special but mandatory type of activity for scientists, I can point out the participation in scientific research projects. This kind of scientific activity in all cases demonstrates the skills of the individual participant in the projects and his capacity for teamwork. During her career, assoc. prof. Kabaivanova was the head of 3 and a participant in a large number of our and international projects. As can be seen below, the competitively funded research projects on which the candidate has worked consistently are on a variety of topics.

1. "Production of thermostable alpha-amylase with bacterial cells immobilized on different membranes" - FNI 1995. BGN 40,000

2. "Production and purification of extracellular hydrolases in water systems" - FNI 1998. BGN 20,000
3. "Bacterial producers of extracellular cyclodextrin-glycosyltransferase" - FNI 2001. BGN 50,000
4. "Isolation and characterization of bacteria, producers of thermostable nitrile-metabolizing enzymes" - awarded by the "Scientific Research Fund" with the First Prize for significant results achieved during its implementation. - 2003 BGN 60,000.
5. "Research of new hybrid nanomaterials for obtaining biocatalysts with immobilized prokaryotic and eukaryotic cells" - FNI 2005. BGN 80,000.
6. "New eco-technologies for biodegradation of organic waste with production of hydrogen and methane". DFNI-E02/2014 BGN 200,000.
7. "A new, integrated biotechnological approach for the preparation, characterization and application of fructans (inulin and fructooligosaccharides) from Jerusalem artichoke (*Helianthus Tuberosus* L.)" - FNI H06/01 2016. BGN 120,000
8. "Isolation, characterization and study of the antitumor properties of natural biologically active substances produced by bacteria and algae" - FNI 2017. DN 11/2 BGN 110,000 - Head
9. "Production of biomethane from agricultural waste with subsequent cultivation of microalgae in the resulting biosludge" - FNI 2018. KP-06-H 26/5 BGN 110,000 – Head
10. "Biorefinery for the transformation of algae biomass into valuable components with added value - from a linear to a circular economy". KP-06-OIIP04/1 - FNI 2018 BGN 120,000
11. "Innovative constructions of photobioreactors based on an integral concept for utilization of CO₂ and obtaining metabolites from algal biomass with high biological and immunostimulating activities" FNI KP-06-H37/12 2019. BGN 120,000
12. "Development of an innovative, waste-free biotechnological process for obtaining inulin and fructooligosaccharides from Jerusalem artichoke for use in medicine and healthy nutrition" BG16RFOP002-1.002-0476-C01 "Support for the development of innovations by start-up enterprises" 2018. BGN 160,000
13. "Optimization of the composition and action of plant hydrolysates to improve soil fertility in the conditions of sustainable agriculture" - FNI KP-06-H 36/1 2019. BGN 120,000
14. KP-06-MNF/6 EOOS'2019 Sixth International Conference with Youth Scientific Session "Ecological Engineering and Environmental Protection" FNI 2019 BGN 9,000
15. "Experimental studies, modeling, monitoring and extreme-seeking optimal intelligent technologies for managing a two-phase process of anaerobic biodegradation of lignocellulosic waste with hydrogen and methane production" - FNI 2020. KP-06-IP-CHINA/3 BGN 250,000 – Head

16. European Space Agency 4000126327/18/NL/SC 2019, "Technological model for microbial degradation of cellulose-containing wastes in a life support system during manned space flights" BGN 162,825

17. 159/UNIV/AMB/2021 Development and design of a website for the needs of the Stefan Angelov Institute of Microbiology at the BAS, a member of the international association of Pasteur Institutes - 2021. BGN 5,859.00

18. "New combined microbial preparations Phytobactin for plant protection with fungicidal and insecticidal effect" - Bulgarian companies 1/2021. - Phytobactin BGN 387,800

19. Project BG05M2OP001-2.013-0001 of the Ministry of Education and Culture "Student practices - Phase 2", financed by OP NOIR

The funding attracted for the above-mentioned projects is impressive and shows the candidate's active activity in providing the material basis for the scientific research of both her team and the institute as a whole.

IV. Publication image of the candidate - citation in the national and foreign literature of the scientific activity

The total IF of the scientific works of Dr. Lyudmila Kabaivanova as of the date of the competition procedure is 55,554. As of the same date, the author of this enviable publication activity has provided evidence for 450 citations, mainly in foreign scientific literature, and the h-index of her publications is 12.

The significant number of publications in journals with an impact factor makes the candidate's name known among scientific circles abroad. Dr Kabaivanova's publications are well known among the foreign community of scientists, microbiologists, ecologists and biochemists engaged in researching general or borderline problems of her subject.

V. Critical Notes and Recommendations

I have no critical comments and recommendations for this voluminous and impressive scientific production covering major trends in modern microbiology, biotechnology and biochemistry. The career development of the candidate is well balanced and evenly passing through all the successive stages of the difficult scientific research work.

At the end of the evaluation of the overall activity of associate professor Kabaivanova, I highlight the extremely pleasant impression created by the well-prepared, systematized and arranged documents for participation in the competition, which greatly facilitate the work of the reviewer.

VI. General assessment of the candidate's compliance with the mandatory conditions and the mandatory quantitative criteria and scientometric indicators

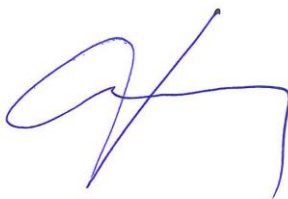
I specify that the conduct of the procedure for the announced competition, as well as the presentation of the only candidate in it, are in full agreement with all national, general academic and specific for IMicB laws, regulations and documents concerning academic growth.

VII. Conclusion

The candidate for the academic position of "professor" in the current competition, assoc. prof. Lyudmila Kabaivanova, is an experienced and established researcher. As a worthy successor of the prominent representatives of the Bulgarian microbiological school, she applies with enviable skill a considerable number of diverse conventional and modern scientific research approaches and techniques. She is fluent in English and has advanced computer skills. She is distinguished by impressive collegiality, tolerance, communication, ability to work in a team, has skills for leading and organizing research work. As a long-time scientific secretary and deputy director, she has considerable experience in the administration and planning of scientific research both at the departmental and institute level.

Based on all the complex positive indicators indicated and described in the relevant sections of my review, I declare that associate professor Lyudmila Kabaivanova fully meets the mandatory conditions and scientometric criteria for the academic position "PROFESSOR". This gives me sufficient reason to vote positively and to recommend to the honorable Scientific Jury, appointed in connection with the announced competition, to accept a proposal to the Scientific Council that assoc. prof. Dr. Lyudmila Vladimirova Kabaivanova be elected as a professor of the scientific specialty "Microbiology", professionally direction 4.3 "Biological Sciences".

Sofia, October 5, 2022



Reviewer:

Prof. Dr. Dimitar Kadiysky, MD, PhD