

Scientific opinion

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Regarding: Evaluation of a candidate, a participant in a competition for the academic position "Associate Professor" at the Institute of Microbiology "Stephan Angeloff" – BAS

1. Information about the contest

The competition is in the professional field 5.11. Biotechnologies, scientific specialty "Biotechnology" for the needs of the "Bioremediation and biofuels" laboratory, department of Biotechnology, announced in the State Gazette No. 21/ 14.03.2025. My participation in the Jury is per Order No. I-66/29.04.2025 of the Director of the Institute of Microbiology.

2. Information about the candidate

The only candidate in the competition for Associate Professor is Dr. ELENA IORDANOVA CHORUKOVA, Assistant Professor at the "Stephan Angeloff" Institute of Microbiology within the Bulgarian Academy of Sciences. Dr. Chorukova has been working at the institute above since 1994. Assistant Professor Elena Chorukova defended her doctoral Thesis in 2009 in the "Applied Microbiology and Microbial Biotechnologies" Department at the Institute of Microbiology, Bulgarian Academy of Sciences. Her Thesis was titled "Neural and Hybrid Modeling and Optimization of Biotechnological Processes."

3. Fulfilment of the requirements for occupying the academic position

A Scopus database search reveals that Assistant Professor Elena Chorukova has co-authored a total of 26 publications, 24 of which are in peer-reviewed biotechnology journals with impact factors and SJR rankings, and two full-text conference papers.

In the competition, Dr. Elena Chorukova participates with 33 scientific publications, 22 indexed in Scopus and Web of Science. She is the first author on 12 scientific works, demonstrating her leading role in their development and publication. The articles have a cumulative Impact Factor of 30.82. Her scientific works accrue points according to the indicators of the Regulations for Development of Academic Staff in the Republic of Bulgaria as follows: Indicator A: 50 points (Doctoral dissertation for an Educational and Scientific Degree "Doctor"). Indicator B: 142.57 points (out of 100 required points), comprising: 1 article in Q1, 4 articles in Q2, 3 articles in Q3, and 2 articles in Q4. Indicator C: 250.86 points (out of 200 required points), comprising: 1 article in Q1, 2 articles in Q2, 3 articles in Q3, 4 articles in Q4, 2 peer-reviewed articles without an SJR, and 11 articles in non-peer-reviewed journals with scientific review or in edited collective volumes. Indicator D (Citations): Dr. Chorukova presents a list of 122 citations in total (with a minimum requirement of 50 points). This includes 92 citations in peer-reviewed

journals (92 x 10 points = 920 points), 21 citations (21 x 3 points), and 9 citations (9 x 2 points), totaling 1001 points.

The candidate's Hirsch index (h-index) from Scopus and WOS is 5 (excluding self-citations).

According to the provided information and supporting documentation, the candidate significantly exceeds the minimum requirements for the position of Associate Professor set forth by the Law for the Development of Academic Staff in the Republic of Bulgaria and its implementing regulations, as well as the additional requirements specified by the "Stephan Angeloff" Institute of Microbiology for the Associate Professor position.

4. Scientific topics

The main scientific areas in which Assistant Professor Elena Chorukova works are:

- (1) Application of deterministic methods for mathematical modeling, control, and optimization of biotechnological processes,
- (2) Application of artificial intelligence methods for mathematical modeling, control, and optimization of biotechnological processes,
- (3) Conducting and investigating biotechnological processes carried out in bioreactors.
- (4) Automatic control systems for biotechnological processes.

She has scientific achievements in all developed thematic areas, with the most important being the application of deterministic methods and artificial intelligence methods for the mathematical modeling, control, and optimization of biotechnological processes. Various mathematical models of different processes have been developed, including anaerobic digestion with methane, hydrogen, or two-stage hydrogen and methane production in a cascade of two bioreactors, using the following substrates: cattle manure, lignocellulosic waste, corn waste product, fruit and vegetable waste, as well as mixtures of different wastes. The models include both deterministic approaches and those utilizing various artificial intelligence methods such as neural networks, genetic algorithms, and other metaheuristic algorithms. Based on these models, the optimal ratio of the working volumes of bioreactors has been determined for several analyzed models, to maximize energy production. Schemes for estimating the specific growth rates of participating bacteria have been developed for some models.

Given her expertise in biotechnology, Assistant Professor Chorukova played a key role in creating and automating a pilot biogas plant with a monitoring and control system at the "Stephan Angeloff" Institute of Microbiology – Bulgarian Academy of Sciences. This biogas plant is designed to implement and scale various anaerobic digestion technologies based on different types of raw materials. Dr. Chorukova made a significant contribution to developing a control system for a cascade of bioreactors producing hydrogen and methane from organic waste. This system was implemented to verify and scale various technologies for two-phase anaerobic biodegradation of different organic wastes. With the help of the developed computer system for monitoring and control of pilot bioreactors, an automatic operating mode has been implemented for a continuous process with simultaneous production of hydrogen and methane.

Dr. Chorukova has contributed to the creation of a biofilm reactor with an immersed fixed bed for biogas production, in which suitable conditions for the immobilization of microorganisms on the solid carrier were established. This reactor is applicable for continuous operation in batch, semi-batch, and continuous modes, avoiding blockage of the immersed bed area's activity through spontaneous detachment of the biofilm from the carrier without interrupting the biogas production process. This bioreactor is protected by a patent.

Also noteworthy are Dr. Chorukova's studies related to the application of generalized nets for modeling biotechnological processes, as well as the application of intercriteria analysis theory, presenting several software implementations of various processes.

As part of a scientific group on bioremediation and biofuels involved in experimental research of various biotechnological processes, Assistant Professor Chorukova actively participates in experimental work, applying her expert knowledge in the setup and conduct of experiments, as well as in their scientific interpretation.

5. Participation in scientific projects and contracts

Assistant Professor Chorukova has an extensive record of participation in scientific forums. She has 48 participations across 33 congresses, conferences, and seminars, 28 of which had international involvement. Dr. Chorukova is the co-author of one patent: "Biofilm reactor with immersed fixed bed for biogas production," and participated in developing one utility model: "Composition for biogas production."

The candidate for Associate Professor has played a crucial role in the execution and leadership of a significant number of scientific projects – a total of 14. Of these, 10 were funded by the National Science Fund, one by the National Innovation Fund, and 3 were international projects financed by the European Union.

6. Conclusion

The scientometric indicators of Dr. Elena Chorukova fully meet and exceed the criteria for appointment to the academic position of Associate Professor, as defined by the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), its implementing regulations, as well as the additional requirements of the Bulgarian Academy of Sciences and the Institute of Microbiology. Her research activity is interdisciplinary, as Dr. Chorukova skillfully integrates knowledge in microbiology with technical disciplines, mathematical modeling, and the application of artificial intelligence. Based on the submitted materials and the analysis of her academic achievements, I give an entirely POSITIVE evaluation of the candidate and strongly support the appointment of Dr. Elena Yordanova Chorukova to the academic position of Associate Professor.

13.06.2025

Signature:

(Prof. Kaloyan Kirilov Petrov, DSc)