STATEMENT

by Associate professor Maria Gerginova, "Stefan Angelov" Institute of Microbiology, BAS

Regarding the competition procedure for the academic position of "Associate Professor" in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, professional direction 4.3. Biological Sciences, scientific specialty Microbiology for the needs of the Department of General Microbiology, Extremophilic Microorganisms Laboratory, Institute of Microbiology, Bulgarian Academy of Sciences. The competition was announced in the State Gazette No. 30/8.04.2025.

This opinion is in accordance with the Order of the Director of the Stefan Angelov Institute of Microbiology - BAS, Prof. Penka Petrova (I-77/28.05.2025) and the decision of the first meeting of the Scientific Jury.

Information about the competition

The only candidate in the competition is Senior Assistant Professor Ivanka Petrova Boyadzhieva PhD, a member of the team at the Extremophilic Microorganisms Laboratory, Department of General Microbiology, Institute of Microbiology - BAS.
The documents submitted by Dr. Boyadzhieva are in accordance with the requirements of the Law on Academic Staff Development in the Republic of Bulgaria (ADASRB) and the Regulations for its implementation, as well as the Regulations for the Development of Academic Staff at the Bulgarian Academy of Sciences and IMicB, BAS for the position of "Associate Professor."

Brief information about the candidate in the competition

Senior Assistant Professor Boyadzhieva graduated with a master's degree from Sofia University "St. Kliment Ohridski", Faculty of Biology, majoring in Molecular Genetics in 1999. In 2008, she received her PhD in Microbiology based on her thesis: "Biosynthesis and properties of superoxide dismutase from thermophilic bacteria isolated from Burgas hot springs" at the Institute of Microbiology, Bulgarian Academy of Sciences. She was appointed as a specialist at the Institute of Microbiology at the Bulgarian Academy of Sciences in the "Extremophilic Microorganisms" laboratory in 2011, followed by the academic position of assistant and, since 2015, assistant professor.

Assessment of the submitted materials

In connection with her participation in the competition, Senior Assistant Professor Boyadzhieva submits a list including 20 scientific publications in journals ranked by quartile (Q1–Q3) according to the SCImago Journal Rank (SJR) classification, three book chapters, and one registered patent. The candidate's publication activity fully meets the established requirements for academic advancement. Among the submitted works, three were published in journals classified in the first quartile (Q1) of their respective scientific fields, eleven in the second quartile (Q2), and five in the third quartile (Q3).

Dr Boyadzhieva is a co-author of 23 scientific papers (excluding those for PhD thesis), six of which Dr Boyadzhieva is the first or corresponding author (with a requirement of five). The total IF of the journals in which the publications were published is 42.694, and the candidate's h- index is 10, with a requirement of 5. The total number of citations of the publications is 163 in the Scopus and Web of Science systems, which shows that the published results are widely accepted in the scientific community. The candidate's active involvement in project activities is impressive - she has participated in a total of 9 projects, 3 of which are national and 6 international, with Assist. Prof. Boyadzhieva as the leader of one of them.

In accordance with the requirements of the ADASRB, I consider it necessary to note that Senior Assistant Professor Dr. Boyadzhieva meets and exceeds the minimum national requirements for obtaining the academic degree of "Associate Professor" in professional field 4.3 Biological Sciences.

A review of the competition documents showed that Dr. Ivanka Boyadzhieva meets the additional criteria for academic advancement in accordance with the Regulations for the Development of Academic Staff at the Institute of Microbiology, Bulgarian Academy of Sciences.

Main areas of research

Dr. Boyadzhieva's scientific and research activities focus on the study of extremophilic microorganisms from various Bulgarian extreme environments. The study of extremophiles significantly improves our understanding of the resilience and adaptability of microorganisms. Metagenomic analysis (16S rRNA) of microbial communities in extreme habitats significantly expands our understanding of biodiversity by allowing the identification of microorganisms that are difficult to cultivate. The ability of microorganisms to function in extreme conditions and produce unique bioactive molecules creates opportunities for their application in industrial and biotechnological processes.

Biodiversity of microbial communities from extreme environments in Bulgaria.

- Based on metagenomic analyses of samples from geothermal springs (63–82°C) in southwestern and central Bulgaria, an extremely high degree of diversity of thermophilic bacteria and archaea has been established.
- New information has been obtained on the biodiversity of bacterial and archaeal communities in crystallization basin P18 in the Pomorie salt pans (34% salinity). An unusually high diversity of taxa has been found.
- High metabolic and antimicrobial activity has been found in extremophile bacteria isolated from the salt pans in Pomorie and Burgas. Their affiliation to the genera *Halomonas, Virgibacillus, Salinicoccus, Brevibacterium*, and others has been proven.
- A halophilic community, capable of degrading polycaprolactone (PCL), polystyrene (PS), and polypropylene (PP), has been isolated in samples from Lake of Burgas, which is contaminated with plastic. The dominant species *Halomonas profundus* has been linked to the biodegradation of plastics for the first time.
- Forty bacterial strains have been isolated from the Mirovo rock salt deposit, 22 of which have been analyzed in detail. 16S rRNA sequencing has revealed that all isolates are

affiliated with six bacterial genera, predominantly *Virgibacillus* and *Halomonas*, and exhibit a broad range of enzymatic activities.

Research on biotechnologically significant microbial enzymes and exopolysaccharides.

A series of studies has been conducted aimed at isolating and characterizing microbial enzymes from halophilic and haloalkalophilic microorganisms. Thermostable and thermophilic enzymes (phytases, pectinases, nitrilase, and cyclodextrin-glucan transferase) isolated from extremophilic bacterial strains have been characterized. The studied enzymes have potential for application in industrial processes, environmentally friendly technologies, and sustainable waste management.

- An alkalophilic phytase from strain *Cobetia marina* 439 has been isolated and characterized, with maximum activity at 10% NaCl and stability over a wide temperature and pH range.
- A new extracellular, haloalkophilic pectinase produced by strain *Virgibacillus salarius* 434 and a thermostable pectinase isolated from strain *Anoxybacillus gonensis* 357 have been studied. The physicochemical characteristics of the isolated and purified pectinases make them suitable for industrial applications in the textile, paper, and food industries.
- A metagenomic analysis has been performed on the phylogenetic diversity in the plastic-contaminated area of the Marikostinovo hot spring, capable of degrading ε-polycaprolactone (PCL) plastic at an extremely high temperature of 55°C. The strain *Brevibacillus thermoruber* 7 with high esterase and lipase activity has been isolated. The physicochemical properties of the purified thermophilic lipase have been characterized and its effect on the surface of PCL has been investigated. The isolated strain has potential for industrial application in the recycling and degradation of PCL waste at high temperatures.
- The halophilic bacterial strain *Chromohalobacter canadensis* 28 has been identified as a new and effective producer of exopolysaccharides (EPS). The exopolysaccharide obtained has excellent moisturizing, emulsifying, and stabilizing properties, suitable for cosmetic and pharmaceutical applications.
- Studies have been conducted to optimize the synthesis of exopolysaccharides from the strain *Virgibacillus halodenitrificans* PSZ-34, which has high emulsifying activity.

Based on the experience gained from her participation in numerous studies, Dr. Boyadzhieva will continue her work on microbial biodiversity in extreme environments with the aim of discovering new microorganisms, enzymes, and biomolecules. A new strategy for the "green" synthesis of nanoparticles using extremophilic bacteria stands out, combining environmental sustainability with high technological efficiency.

The analysis of the research activity of Assist. Prof. Boyadzhieva is entirely within the scope of the announced competition. The research in which Dr. Boyadzhieva has participated belongs to several interrelated areas and combines significant scientific and applied achievements in the field of microbiology and biotechnology.

Based on my personal impressions, I consider Dr. Boyadjieva to be an established researcher, and I believe that her appointment to a higher academic position will make a

significant contribution to the further development of research on extremophilic microorganisms, their biodiversity, and potential.

Conclusion

Based on the scientific contributions mentioned above, the complete documentation for the competition, and the undeniable quality of the projects submitted for the competition, I give a positive assessment of Dr. Ivanka Boyadzhieva's participation in the competition.

As a member of the scientific jury for the announced competition, I strongly recommend that the members of the distinguished scientific jury and the Scientific Council of the Institute of Microbiology at the Bulgarian Academy of Sciences vote for the appointment of Senior Assist. Prof. Dr. Ivanka Boyadzhieva to the academic position of **Associate Professor** in the professional field 4.3. Biological Sciences, scientific specialty "Microbiology," in the Department of General Microbiology, Laboratory of Extremophilic Microorganisms, Institute of Microbiology at the Bulgarian Academy of Sciences.

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