SCIENTIFIC STATEMENT

From Prof. PhD Elena Ivanova Georgieva

on conducting a competition for the academic position "Associate Professor" in a professional field 4.3. Biological sciences (General microbiology and biology of extreme microorganisms), for the needs of Sofia University "St. Kliment Ohridski ", Faculty of Biology, Department of General and Industrial Microbiology, announced in the State Gazette, issue 87 of 19.10.2021.

1. **Common part**

The competition for "Associate Professor" in the specialty "General Microbiology and Biology of Extreme Microorganisms", field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.3. Biological Sciences is announced in SG no. 87 of 19.10.2021 for the needs of Sofia University "St. Kliment Ohridski", Faculty of Biology, Department of General and Industrial Microbiology. According to the announced competition, there is one candidate – Assistant Professor, PhD Anna Atanasova Tomova. The procedure for opening and announcing the competition has been followed. The documents are precisely prepared and fully compliant with the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, its amendments and the Regulations on specific conditions and procedures for obtaining scientific degrees and holding academic positions at the Faculty of Biology.

2. **Brief biographical data and career development of the candidate.**

PhD Anna Atanasova Tomova graduated from the Faculty of Biology at Sofia University in 1999 and graduated as a "Master" in Molecular Biology, majoring in Microbiology, and in 2010, after successfully defending her doctoral thesis: "Characteristics of thermophilic aerobic spore-forming bacteria with carbohydrate degrading activities isolated from Bulgarian hot springs" at the Institute of Microbiology. (IMiK) / BAS, Laboratory of Extremophilic Bacteria, the Higher Attestation Commission in January 2011 awarded her with PhD in Microbiology. After graduating from high school she started working in 2000 as a specialist microbiologist at IMiK/BAS, where her professional realization began. In the same institute, in the period 2002-2012 she holds several scientific positions: n.s. III degree, n.s. II st., n.s. I st. and Assistant Professor. In 2015 Anna Tomova works as Assistant Professor in NIS, Sofia University "St. Kliment Ohridski" and hold this position until 2016, and from January 2017 has been appointed to a permanent employment contract with the position of Assistant Professor in the Department of General and Industrial Microbiology at the Faculty of Biology, Sofia University "St. Kliment Ohridski", where she still holds this position. So far, PhD Tomova has a total work experience of 21 years, 19 years of which in her specialty. From the beginning of her professional activity until now, the direct scientific activity and research interests of PhD Tomova throughout her career are entirely related to the topic of the competition. Using the most modern means and approaches, PhD Tomova has focused her research on solving important scientific challenges in microbiological processes, namely: isolation and characterization of pure cultures of thermophilic bacteria, producers of industrially important biologically active substances - enzymes and polysaccharides and

characterization of their physicochemical properties, study of microbial biodiversity, oxidative stress in yeast, etc. Thematically, her scientific output is homogeneous, and her scientific contributions are mostly fundamental, but some achievements may find practical application. In the course of her career development, PhD Anna Tomova has completed a three-month specialization, winning a scholarship under FEMS (2001), Novozymes, Denmark and a two-week specialization at CNR, Italy (2009) in Bilateral Laboratory Cooperation. Extremophilic Bacteria, BAS and the Institute of Biomolecule Chemistry, CNR. Although both specializations are short-term, the knowledge and experience gained from them have contributed to the realization of scientific interests and professional advancement of PhD Tomova.

3. General data on the thematic development of the candidate.

PhD Tomova's scientific production, including her doctoral dissertation and publication, covers the scientometric indicators for this academic position and fully corresponds to the profile of the announced competition. The entire scientific activity of PhD Tomova has so far been presented in a total of 23 scientific papers, of which 20 publications are in journals with JCR Impact Factor = 26.055, which for the period 2000-2021 are cited 359 times (SCOPUS), with Hirsch index (h-index) according to Scopus 10. Three of the publications in the presented list with № 4, 5 and 7 are included in the dissertation of PhD Anna Tomova for the acquisition of ONS "Doctor". For participation in the competition for the academic position of "Associate Professor" PhD Tomova presents a list of 20 scientific articles and one chapter of a book. Of these 20 articles, 17 have been published in indexed and referenced in world-renowned databases of scientific information, 3 are publications in proceedings of scientific conferences printed in full in publications that are not referenced and indexed. In the articles for participation in the competition PhD Tomova is the first author in 4 publications, in 5 of the second, and in the others she is a co-author or third and other positions. With posters, section reports and oral presentations, some of the candidate's results were presented at 20 scientific forums, 12 of them with international participation. The information on the fulfillment of the minimum national requirements under Art. 2b of ZRASRB for scientific field 4. Natural sciences, mathematics and informatics professional field: 4.3 Biological sciences, from Assistant Professor PhD Anna Atanasova Tomova – candidate for the academic position "Associate Professor" forms the following indicators: group A – 50 points; group B – 100 points; according to indicator G – 205 points at a required minimum of 100 points, and according to indicator D (cited) collects 448 points at a minimum of 100 points. Thus, with a required minimum of 420 points for "Associate Professor", according to PPZRASRB, PhD Tomova forms 803 points, which exceeds the minimum national requirements required for this academic position. The distribution of the candidate's scientific output by quartiles is as follows: 9 articles are with quartile Q2 and 11 with quartile Q3. PhD Tomova's professional skills are reflected in her successful participation in 18 research projects – 5 international, 10 national and 3 international educational. Assessment of the high competence of the candidate are the 7 successfully defended graduates under her leadership, as well as developed by her in Bulgarian and English under the Erasmus^{+} 3 textbooks covering issues in the field of modern biotechnology, organic farming and modern omix- based research in systems biology. PhD Tomova's participation in teaching

and training is significant. The issued reference for her general and classroom workload as a lecturer in the department certifies that for the period 2016 – 2021 her total study load is 4745 hours, as for 2020 – 2021 she has spent over 500 teaching hours. In the course of scientific research, in the training of students with bachelor's and master's degrees at the Faculty of Biology, Assistant Professor, PhD Anna Tomova integrates the acquired knowledge and skills in independently developed and delivered lectures and exercises in 3 disciplines. She is a co-author in the development of exercises for 4 courses, which she conducts in bachelor's and master's degrees. As a successful teacher and established scientist are the new teaching materials developed by her: 2 new courses of lectures on elective subject, 5 new practical exercises, conducting a basic course of lectures in 2 joint courses and a holder in 2 independent courses in elective lectures.

4. **Evaluation of the scientific achievements in the research work of the candidate.**

PhD Tomova's research activities and achievements are aimed at solving fundamental and applied research problems. Although all peer-reviewed papers are in the field of general microbiology and biology of extreme microorganisms, they can be thematically systematized in 4 main areas: *a) Isolation and characterization of cultivated bacteria from extreme niches and description of new species; b) Microbial enzymes and exopolysaccharides of biotechnological importance; c) Biodiversity of microbial communities in extreme niches; d) The yeast Saccharomyces cerevisiae as a model system for studying the state of rest*. In each of these areas the candidate's work demonstrates high professional competence. I accept and approve PhD Tomova's author's report on her scientific contributions and the way they are presented, a significant part of which are original and new achievements. New extremophilic microorganisms involving new metabolic genes have been described, which could be potential sources for the industrial production of a number of important biologically active substances. The capacity of bacterial strains to produce psychrotolerate enzymes and bioactive metabolites has been established. For the first time, the candidate conducted an in-depth study of the taxonomic affiliation, biodiversity and biological activity of cultivated bacteria inhabiting the gallery of prehistoric drawings in Magurata Cave, Bulgaria. PhD Tomova deepened her research in this direction and managed to characterize the lipid profile of strains isolated from Bulgarian hot springs, belonging to two newly described bacterial species *Anoxybacillus bogrovensis* and *Anoxybacillus rupiensis*. Isolated extremophilic (thermophilic and psychrophilic) bacteria have been described as promising producers of enzymes and bioactive compounds. /*Publications: B4-2, B4-5, G7-4, G7-5; conferences: 10, 17*/.

Another important thematic problem of biotechnological importance, which the candidate develops and receives original results is the isolation of new microorganisms producing exopolysaccharides and new enzymes that degrade the latter in order to more effectively apply them in environmentally friendly industrial production. She isolated a thermophilic bacterial strain of *Bacillus sp*. producer of thermostable inulinase, which is characterized by high temperature of growth and synthesis of the enzyme, high yield of inulinase and has established an exo-mechanism of action of inulinase and the ability to civilizes the substrates inulin, raffinose and sucrose to the final product fructose, and with these properties can be used successfully for the hydrolysis of high-sugar syrups. Using

modern methods, Dr. Tomova isolated and characterized an exopolysaccharide from the thermophilic strain *Brevibacillus thermoruber* 438 and accurately analyzed the physicochemical properties of the first reported thermostable gelan lyase synthesized by the thermophilic strain *Geobacillus stearothermophilus* 98 for degradation. Isolates and purifies extracellular thermostable lipase produced by thermophilic bacterial strain *Bacillus stearothermophilus* MC7. From Bulgarian hot springs it isolated two bacterial producers of thermostable starch-degrading enzymes - α-glucosidase and β-amylase. It is important to note that the studied enzymes, thanks to their proven good physicochemical properties and cheap production, determine the industrial interest in them in the starch and brewing industry as gelling, emulsifying and flocculating agents. The obtained results are summarized in *publications B4-1, B4-3, G7-1, G7-3, G7-6, G7.0-1, G7.0-2, conferences 9, 11, 13, 14, 15, 16.*

In the course of her research, PhD Tomova has made important contributions to the biodiversity of various, little-studied, microorganisms living in habitats, including one or more extreme environmental factors. With the application of new, molecular genetic methods, she managed to perform taxonomic, phylogenetic and functional characterization of microbial populations from several different extreme niches. Using metagenomic analysis, she studied the biodiversity of an archeological community from the Vlasa hot spring, Velingrad, based on 16S rDNA and GH4 sequences. It has proven the presence of five new phylogenetic units in the archaeological community, based on the low percentage of homology of their 16S rDNA sequences with those deposited in GenBank. The identified new 16S rDNA and GH4 sequences have already been deposited in GenBank. By studying the genes for 16S rDNA and GH, the candidate studied: a) the archaeological biodiversity in the Varvara hot spring, Bulgaria, b) the bacterial community in the gallery with prehistoric drawings in the Magurata cave and c) bacteria and archaea in two Bulgarian hot springs - Levunovo and Vetren Dol. PhD Tomova found that the analysis of the metabolic gene for glycoside hydrolases 57 allows a more in-depth assessment of microbial diversity and the presence of specific taxonomic groups. / *Publications: B4-4; G7-2; G7-7, G7-8* /

The information received by PhD Tomova on the possibilities for application of the yeast *Saccharomyces cerevisiae* as a model system for studying the state of rest is summarized and discussed in detail. The role of the antioxidant enzymes SOD and catalase in the entry and survival of cells at rest in two different cell lines - mouse and human fibroblasts - was studied. The influence of the carbon source on cell differentiation (spores / Go cells) in diploid strains of the yeast S. cerevisiae was studied. The adaptive cellular response of yeast cells in the Go phase to oxidative and toxic stress was studied. The redox status of cells at rest was characterized by comparative characterization of intracellular concentrations of reactive oxygen species (ROS) and NADH / NADPH. The studies were performed with stationary cultures of diploid strain of S. cerevisiae. PhD Tomova's in-depth training is evident from the many proven and highly rated published scientific contributions in this area. /*Publications: G7-9, G7-10, G7-11, G7-12, G7.0-3; conferences: 1, 2, 3, 4, 5*/.

5. Conclusion.

The only candidate who appeared to participate in the competition for "Associate Professor" is Assistant ProfessorPhD Anna Tomova. From the presented report it is evident that she is a creative person with emphasized scientific interests, original scientific ideas and important scientific achievements. Proof that she is a specialist in the field of general microbiology and biology of extreme microorganisms is her active publishing activity, high citation rate, proven skills in training graduates and participation in the development of a large number of research projects. The academic and professional history of the scientific production, personal qualities and scientific contributions of the candidate show that they fully meet and exceed the recommended criteria of the Academic Development Act in the Republic of Bulgaria, the Regulations for its implementation and the internal regulations of the Bulgarian Academy of Sciences. From everything said so far, I find it quite reasonable, convinced to recommend to the esteemed Scientific Jury and the Scientific Council of the Faculty of Biology of Sofia University "St. Kliment Ohridski" to award PhD Anna Atanasova Tomova the academic position of "Associate Professor".

28.01.2022 Reviewer:

/Prof. PhD Elena Georgieva/