REVIEW

from Atanas Ivanov Pavlov, DScTech – Full Professor at the University of Food Technology – Plovdiv; Professor at the Institute of Microbiology, Bulgarian Academy of Sciences (BAS); Corresponding Member of Bulgarian Academy of Sciences, Corresponding Member of Saxon Academy of Sciences

on the competition papers for the academic position of **Professor** at the Institute of Institute of Microbiology, Bulgarian Academy of Sciences

Higher education area: 4.3. Biologycal Sciences

Professional area: Microbiology, Genomics and Gene expression in prokaryotes

Assoc. Prof. Penka Mladenova Petrova DSci. from Laboratory of Microbial Genetics, Department of General Microbiology, Institute of Microbiology is an applicant to the position of Professor and participant in the competition advertised in State Gazette No 47 of May 22, 2020, and on the website of the Institute of Microbiology, Bulgarian Academy of Sciences.

1. Overview of submitted competition documents

Subject:

By order № I-81 of 01.07.20 of the Director of the Institute of Microbiology-BAS I was appointed as a member of the Scientific Jury of a competition for the academic position of 'Professor' at the Institute of Microbiology at BAS, in professional field 4.3. Biological Sciences (Microbiology - Genomics and Gene expression in prokaryotes), announced for the needs of the Department of General Microbiology, Laboratory of Microbial Genetics.

The only candidate for participation in the announced competition has submitted documents: Assoc. Prof. Penka Mladenova Petrova from the Department of General Microbiology, Laboratory of Microbial Genetics at the Institute of Microbiology - BAS.

The set of materials presented by Assoc. Prof. Penka Petrova is in accordance with the Rules on Development of the Academic Staff of the Institute of Microbiology, BAS and includes the following documents:

1. Application for participation in the competition;
2. Curriculum Vitae according to the European model;

3. Diplomas for acquiring the educational degree "Master", the scientific and educational degree "Doctor", the scientific degree "Doctor of Science", as well as for holding the academic position "Associate Professor";

4. Abstracts of the dissertations for acquiring the scientific and educational degree "Doctor" and the scientific degree "Doctor of Sciences";

5. Official note for work experience in the specialty;

6. Complete list of publications for the whole scientific career, list of publications after the academic position "Associate Professor", list of publications included in the dissertation for the award of the degree "Doctor of Sciences", list of publications included in the dissertation for awarding the educational and scientific degree "Doctor";

7. Copies of the publications;

8. List of citations in scientific journals, referenced and indexed in Scopus;

9. List of participations of the candidate in scientific conferences;

10. Information for the candidate's participation in research projects;

11. Brief information about the research work and the contributions;

12. Information on compliance with the minimum requirements of the Law on Academic Staff Development in the Republic of Bulgaria and the Rules on Academic Staff Development of the Institute of Microbiology, BAS (criterion A; criterion B; criterion C; criterion D; criterion E; criterion E);

14. Leading and corresponding author in publications in journals with IF, monographs, chapters of monographs;

15. Information on the Impact factor;

16. Information about the h-index;

17. List of defended doctoral students;

18. Copy of the State Gazette with the published announcement.

The candidate Assoc. Prof. Petrova has applied a total of 67 scientific papers, 1 patent and a list of 23 research projects. 36 scientific papers and 1 patent are accepted for review, which are outside the dissertation for educational and scientific degree "Doctor" and those reviewed in the competition for "Associate Professor", and are considered in the final evaluation, as well as 23 research projects. 31 scientific papers related to the dissertation for obtaining the educational and scientific degree "Doctor" and the

competition for the academic position "Associate Professor" are not reviewed. The distribution of scientific papers by relevant sections, in the country and abroad, is as follows: 22 publications in refereed foreign publications, of which 20 in journals with Impact Factor or Impact Rank (6 in journals from the first quartile - Q1; 9 - Q2; 3 - Q3 and 2 - Q4). There are also 2 book chapters, 8 publications in refereed Bulgarian journals and 4 published materials in proceedings of scientific forums. In 22 publications, Assoc. Prof. Petrova is a leading, first or correspondent author - an indicator that takes into account the contribution to concrete scientific papers. No documents for implemented developments in the industry have been submitted.

2. Short biography of the candidate

Assoc. Prof. Penka Petrova graduated with a master's degree in "Biotechnological Processes" with a specialization in "Genetic and Cell Engineering" at the Faculty of Biology, Sofia University "St. Cl. Ohridski" and acquired the educational and scientific degree" Doctor" in 2003 at the Institute of Microbiology at the Bulgarian Academy of Sciences with the specialty "Microbiology" and the topic of the dissertation "Creation of a gene cloning system for *Streptococcus thermophilus*". Assoc. Prof. Petrova began her career in 1995 at the Institute of Molecular Biology, Section "Regulation of Gene Activity" as a specialist. From 1997 to 2003 Assoc. Prof. Petrova was a full-time doctoral student at the Institute of Microbiology at the Bulgarian Academy of Sciences, with which the Institute connected her 19 years of work and passing through all levels of scientific growth from Research Associate to Associate Professor and Doctor of Sciences. Since 2013, Assoc. Prof. Petrova is the head of the Laboratory of Gene Expression, and since 2018 she has been the head of the Department of General Microbiology. Over the years, Assoc. Prof. Petrova has managed a large number (42) of graduates from Bulgaria and abroad. At present Assoc. Prof. Petrova is a member of the Union of Scientists in Bulgaria, Section of Microbiology, Immunology and Virology; member of the European Federation of Microbiological Societies (FEMS); member of the editorial board of the Journal of Investigative Genomics, MedCrave Group, USA. Since 2015, Assoc. Prof. Petrova has been Chair of the Commission for Work with GMOs (at IMiKB) at the Ministry of Environment and Water. In 2020, Assoc. Prof. Penka Petrova has been elected for the

director of the Institute of Microbiology at the Bulgarian Academy of Sciences. The data from the career development of Assoc. Prof. Petrova show consistency and a good professional level.

3. General characteristics of candidate's work

The most recognizable area, among the world microbiological community, of the Bulgarian microbiological science are the researches, connected with the lactic acid bacteria. On the other hand, the strategic goal of the European Union and the Member States is to support the creation of a sustainable, bio-based economy by translating biological knowledge into industry under the common theme "Bio-based economy 2030". The identification and characterization of new microorganisms for industrial production, as well as the further development of microorganisms in new platform organisms for the use of their metabolic potential in industrial production are two of the main directions described in the strategic documents. In these areas are situated the research activities of Assoc. Prof. Petrova, described in the presented scientific papers attached to this competition. Therefore, the developed scientific topics are timely and relevant. In my opinion, the developments presented in the publications of Assoc. Prof. Petrova could be further developed into industrially applicable processes.

The presented documents characterize Assoc. Prof. Petrova as one of the recognizable microbiologists in Bulgaria. Her scientific output of 67 scientific papers is an indicator of intensive work in the field of scientific research. The presented scientific papers in connection with this competition show that she is an active scientist. The number of scientific publications and their distribution by rubrics, presented above, correspond to the criteria of the Institute of Microbiology at BAS and to the minimal national requirements for holding the academic position "professor". The presented scientific articles are in the field of microbiology and biotechnology. The areas of scientific interest of Assoc. Prof. Petrova could be summarized as follows:

- Isolation, identification and taxonomy of bacteria;
- Metagenomic studies of microbial communities, sequencing of prokaryotic genomes.

- OMICS studies (genomics, transcriptomics and proteomics) of model systems of prokaryotes and eukaryotes. Cloning and expression of target genes in prokaryotic and eukaryotic hosts.

- Biosynthesis of low molecular weight compounds as an alternative to petroleum products.

The published data, in the indicated areas, are added value to both the fundamental and the applied knowledge.

The main contributions, a consequence of the scientific activity of Assoc. Prof. Penka Petrova can be referred to as a novelty for science and applied:

- Novelty for science

= The genes responsible for the hydrolysis of α-glucans in some species of lactic acid bacteria have been identified;

= A new cgt gene and the enzyme cyclodextrin glucanotransferase have been identified in *Bacillus pseudalcalophilus*, and the amino acid sequence homology with the enzymes known so far is low;

= The relationship between the hydrophobicity of the cell surface of lactic acid bacteria and their resistance to organic solvents has been proven;

= Extracellular α-amylase gene was introduced in *Zymomonas mobilis* DSM 424 and its heterologous expression was demonstrated.

= Metagenomic sequencing of a cellulose-degrading microbial community has been performed.

- Applied:

= The world's first amylolytic representatives of the species *Lactobacillus sakei* and the genus *Enterococcus* have been isolated;

= Recombinant cyclodextrin glucanotransferase enzyme is immobilized in magnetically modified carriers to produce cyclodextrins;

= It has been proven that the Bulgarian strains *L. delbrueckii* subsp. *bulgaricus* synthesize galacto-oligosaccharides in milk and lactose due to the rare transferase activity of the enzyme β-galactosidase;

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= A recombinant *Klebsiella pneumoniae* G31 – A strain was constructed with the α-amylase gene from *Bacillus licheniformis* 44MB82/G introduced, which is capable of converting highly concentrated starch solutions to 2,3-butanediol;

= A process of direct conversion of inulin into lactic acid has been carried out by simultaneous saccharification and fermentation by the Bulgarian *Lactobacillus paracasei* B41;

= A new biotechnological process for microbial production of fructose from inulin has been developed.

The contributions listed above, as well as the scientific indicators of the presented scientific production (731 citations, Impact factor - 37.16 of the publications related to the competition and H-index 12), define Assoc. Prof. Petrova as a recognizable scientist in her field of competence.

This scientific production is based on good research funding. Assoc. Prof. Petrova is the leader of the Bulgarian teams of 3 international projects. She has been a leader of 3 national projects, as well as a participant in 12 national and 2 international projects. The funds raised by Assoc. Prof. Petrova for the various projects she has managed amount to BGN 252,000.

Assoc. Prof. Penka Petrova has supervised 2 **successfully defended doctoral students** and 5 graduates.

4. Assessment of the personal contribution of the candidate

As far as we evaluate a candidate for the academic position of "Professor", I would like to emphasize that in the publications in which Assoc. Prof. Petrova is a leading author (corresponding or last) her scientific handwriting is clearly outlined. The presented original

scientific results and the formulated contributions to the development in the respective scientific field, in these publications, can also be defined as a result of the management of Assoc. Prof. Petrova. However, in a large number of publications the co-author of Assoc. Prof. Petrova is her husband Prof. Kaloyan Petrov. Knowing the work of both colleagues, I can correctly and accurately distinguish which part of the published results is based on the competencies of Assoc. Prof. Petrova and which of Prof. Petrov. Such co-authorship is not in conflict with the normative documents.

5. Critical comments and recommendations

I have no general or formal criticism of the candidate. Assoc. Prof. Petrova develops her scientific career, following her principles and visions for career development. I would recommend Assoc. Prof. Petrova in the future to pay more attention to the methodological contributions, because this is actually what remains of the work of scientists. I think that Assoc. Prof. Petrova has the competencies and it is time to expand her participation in editorial boards of foreign scientific journals.

6. Personal impressions

I have known Assoc. Prof. Petrova since she started working at the Institute of Microbiology at the Bulgarian Academy of Sciences. During this time she developed from a doctoral student and Assistant Professor to the director of the Institute. Over the years we have not had common professional activities, but our relationship has always been correct and in the spirit of collegiality. In addition, for the recognizability of Assoc. Prof. Petrova among the scientific college in Bulgaria is her active participation in scientific juries (11 in number), related to various procedures under the Law on Academic Staff Development in the Republic of Bulgaria.

CONCLUSION

The documents and materials submitted by Associated Professor Penka Mladenova Petrova comply with all the requirements of the Law on Academic Staff Development in the Republic of Bulgaria (ZRASRB), the Rules for the Implementation of ZRASRB, the

Rules for the Implementation of the ZRASRB of BAS, and the Rules of the Institute of Microbiology - BAS.

The candidate has submitted a sufficient number of scholarly works published later than the materials included in the defense of the doctoral degree and of the academic position Associated Professor’s competition. The candidate's work comprises original scientific and applied contributions that have received international recognition, a representative part of which has been published in journals and scientific compendiums published by international academic publishers. Assoc. Prof. Penka Mladenova Petrova's scientific level is good.

The results achieved by Assoc. Prof. Penka Mladenova Petrova in her research fully comply with the specific requirements of the Institute of Microbiology-BAS Regulations for the application of ZRARB.

Having acquainted myself with the materials and scholarly works submitted in relation to the competition, the analysis of their importance and scientific and applied contributions contained therein, I consider it should be legitimate to give my positive opinion and to recommend that the Scientific Jury prepare a report to the Scientific Council of Institute of Microbiology-BAS regarding the appointment of Assoc. Prof. Penka Mladenova Petrova as Professor at Institute of Microbiology-BAS in the higher education area of 4.3. Biological Sciences (Microbiology, Genomics and Gene expression in prokaryotes).

15. 09. 2020 Review prepared by:

(Cor. Mem. Prof. Atanas Ivanov Pavlov, DScTech)