

## REVIEW

Regarding a competition for a "Professor" in a professional field 4.3. "Biological Sciences", specialty "Microbiology" ("General and food microbiology"), announced for the needs of the Department of General and Industrial Microbiology at the Faculty of Biology of Sofia University "St. Kliment Ohridski "

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### 1. Common part

The competition for the academic position "professor" in a professional field 4.3. "Biological Sciences", specialty "Microbiology" ("General and Food Microbiology") was announced in SG no. 88 of 13.10.2020 for the needs of the Department of General and Industrial Microbiology at the Faculty of Biology of Sofia University "St. Kliment Ohridski ". The only candidate in this competition is Assoc. Prof. Dr. Petya Koycheva Hristova, working as a lecturer on a basic employment contract in the same department. The review of the documents shows that the competition procedure has been followed, as well as that the documents have been prepared in accordance with the requirements of the Law for Development of the Academic Staff of the Republic of Bulgaria and the Regulations for its implementation.

### 2. Biographical data about the candidate

Assoc. Prof. Dr. Petya Hristova in 1987 graduated from the Faculty of Biology at Sofia University "St. Kliment Ohridski "specialty" Molecular and functional biology "with specialization" General and industrial microbiology ". In 1996, the Higher Attestation Commission awarded her "PhD" in the scientific specialty "Microbiology" with the then current code 01.06.12. The entire professional career of Assoc. Prof. Dr. Petya Hristova was transferred to the Department of General and Industrial Microbiology at the Faculty of Biology, Sofia University, where she successively held the academic positions of Assistant (1997 - 2000), Senior Assistant (2000-2002), chief assistant (2002 - 2012) and associate professor (2012 - present). She has held and continues to hold senior administrative positions - Head of the Department of General and Industrial Microbiology (2016 - present) and Deputy Dean of the Faculty of Biology (2016-2020). Therefore, Assoc. Prof. Petya Hristova has spent enough time in each academic position, which guarantees the mastery of the

specific duties and responsibilities set out in their respective job descriptions. She also has serious administrative experience.

No data on memberships in professional companies are presented.

### 3. Scientific works

#### 3. 1. Overview of scientific papers and their citation

The total number of published works of Assoc. Prof. Dr. Petya Hristova on the topic of the competition is 65. Four of them, including Abstract, are related to the defense of a doctoral dissertation. Twenty-six scientific publications are provided to meet criteria B (for the academic position of "associate professor"), of which 20 are in referenced publications, of which 19 with journals with impact factor (IF), 5 with SJR, 1 is in international edition without IF or SJR (in Russian) and 1 is a chapter from a book in French by ECONOMICA (Paris, France). The total IF of these publications is 19.86 and the total SJR is 0.854. In addition, there are 4 publications in Bulgarian scientific journals without IF or SJR, three more - in scientific and applied journals and three full text reports are published in proceedings of national and international conferences. There are also three e-learning and distance learning materials on the Leonardo da Vinci website and two others on the Erasmus + Multi-purpose Center for Adult Education in a Clean Environment page. .

Eighteen scientific papers have been submitted to meet the criteria for the position of "professor". One of them is the habilitation work (monograph) "Cross-pathogens - the new biological dangers in plant foods" (190 pp.) Of the University Publishing House "St. Kliment Ohridski ". Fourteen scientific publications are with IF or SJR (11 with IF and 3 with SJR). The total IF of these publications is 9,974 and the total SJR is 0.437. Apart from them, there are 3 other publications in journals without IF or SJR (one in the Annual Book of Sofia University (v. 104) and two in the Journal of BioScience and Biotechnology) and two materials in a project to Erasmus+. Here are included two textbooks - mainly revised one in a co-authorship with Prof. Stoyan Vlahov "Microbiology" (513 pages) and "Pathogenic microorganisms" (150 pages), both published in 2020.

Some of the publications for this competition have been published in prestigious scientific journals such as Polar Biology, Journal of Plant Pathology, Zeitschrift Fur Naturforschung - Section C Journal of Biosciences, Applied and Environmental Microbiology, Journal of Applied Microbiology, European Journal of Plant Pathology and others. In general, the publishing activity is intensive and systematic. All 18 scientific publications under item D (including textbooks and electronic educational materials are not considered) are from 2013 onwards, ie. after the habilitation

of Assoc. Prof. Petya Hristova, which testifies to intensive research work in the period before the competition. This fact suggests a significant increase in citations in the next few years.

I have no common publications with Assoc. Prof. Dr. Petya Hristova.

The candidate in the competition has participated in 33 scientific events with posters or reports. 283 citations were found in the databases of Scopus, ISI Web of Knowledge, Google Scholar and others are presented. The total number of citations in Scopus alone is 221, from 2013 until today they are 113, and for the last 5 years - 73. Scopus h-index = 9.

These scientometric indicators fully satisfy the minimum requirements for the academic position "professor" according to the Regulations for application of the Law for development of the academic staff of the Republic of Bulgaria and the Regulations for the conditions for acquiring scientific degrees and holding academic positions at Sofia University. The research and works of Assoc. Prof. Dr. Petya Hristova, as well as her contributions, are on the topic of the competition.

In 2015 Zdravka Koleva and in 2016 Mustafa Guzel, who are PhD students under the joint scientific guidance of Assoc. Prof. Dr. Petya Hristova and Prof. Petya Moncheva, successfully defended their doctoral theses in the field of the competition. Currently, Assoc. Prof. Dr. Petya Hristova is the research supervisor of three full-time doctoral students, two of whom supervise independently and one - jointly with Assoc. Prof. Dr. Ganka Chaneva. Under the scientific guidance of Assoc. Prof. Dr. Petya Hristova, after 2012 20 master's students and 2 bachelors defended their dissertations, and before her habilitation - another 13 master students. These numbers testify to a very intensive work with graduates and doctoral students.

### 3.2. Evaluation of the scientific contributions of Assoc. Prof. Dr. Petya Hristova

Assoc. Prof. Dr. Petya Hristova has highlighted scientific contributions in five areas: 1) biological hazards in food; 2) antibiotic resistance to opportunistic pathogens; 3) molecular methods for taxonomy of microorganisms; 4) preparation of biologically active substances with antimicrobial action and 5) microbiological control of probiotics. All contributions are in the field of this competition and are detailed.

#### 3.2.1. Biological hazards in food

The monograph "Cross-pathogens - the new biological hazards in plant foods" (2020) addresses the current topic of the role of pathogens in plant foods as a danger to humans. Modern views on the ability of pathogenic microorganisms to persist in plants while maintaining their virulence to humans, as well as their ability to cause plant diseases, are presented in detail. In addition, cases

have been considered in which plant pathogens have acquired the ability to cause disease in humans. These data belong to a new scientific field, which examines the cross-infections that occur between representatives of different biological kingdoms and the possibilities for the assimilation of so many different hosts by the same microorganisms. New research strategies are proposed to minimize the risk of microbial contamination in food. According to Assoc. Prof. Dr. Petya Hristova, these studies prove that a new type of relationship in the ecosystem has been established. Another explanation is possible - only now are some adaptive transformations of the genome of pathogenic microorganisms beginning to be clarified.

### 3.2.2. Antibiotic resistance

The resistance of some major microorganisms inhabiting the rhizosphere (the narrow soil layer that covers the roots of plants), such as *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia*, *Escherichia coli*, *Klebsiella* sp. to antibiotics. They are present in the most commonly consumed fresh plant foods. They are able to cross the boundaries of their plant hosts and are increasingly identified as the cause of nosocomial or socially significant human infections. Bacterial resistance has been linked to the emergence of strains that produce enzymes capable of breaking down antibiotics. Infections caused by extended-spectrum beta-lactamase producers, carbapenemases and metallo-beta-lactamases have been found to be particularly dangerous among species of the family Enterobacteriaceae (*E. coli*, *Klebsiella* sp.) And the genera *Pseudomonas* and *Acinetobacter* because resistance genes are found in plasmids and simple horizontal gene transfer can eliminate the effectiveness of a whole class of antibiotics. A higher incidence of drug resistance has been observed among bacteria due to the expression of these enzymes. In addition, the following have been developed:

- a variety of tests for the rapid and effective identification of producers of the enzymes beta-lactamases, carbapenemases and metallo-beta-lactamases, and
- methodology for assessing the degree of resistance to other antibiotics of carbapenem-resistant and beta-lactamase-producing bacteria. Carbapenem-resistant strains have been found to have a high degree of resistance (over 80%) to ampicillin-sulbactam, ciprofloxacin and cefepime, but very rarely (<1%) they produce metallo-beta-lactamases. This contribution is of great scientific and applied importance because it outlines the most appropriate drugs for some infectious diseases and eliminates pointless antibiotic therapies.

### 3.2.3. Molecular identification of microorganisms

The main publications of the candidate in this competition are related to a developed set of molecular methods for species and strain identification of microorganisms. The taxonomic characteristics (including strain) of microorganisms are a fundamental problem due to the possibility that representatives of the same species have up to 25% difference in DNA.

The microbiome in the mixed biocenoses of the rye test, the intestinal tract of the garden snail *Cornu aspersum* and the bee *Apis mellifera* was determined by a combination of different phenotypic and genotypic methods. These include the co-administration of PCR amplification of the 16S rDNA gene with restriction analysis combined with cluster analysis and phenotypic culture methods. Based on the structure of the ribosomal operons and the polymorphism of the 16S-23S ribosomal intergenic regions, an algorithm for rapid typing of bacteria in food has been developed. The originally developed scheme for the identification of lactic acid bacteria was supplemented by the inclusion of molecular analyzes such as multiplex PCR, PCR with species-specific primers and sequencing. With the help of these methods the seasonal change of the intestinal bacteria of *C. aspersum*, as well as their dependence on the life cycle of this species has been proven. In addition, the presence of the lactic acid microbiota in the digestive tract of the garden snail has been proven for the first time. The main representatives of the intestinal microbiota of Bulgarian bees were also identified - *Lactobacillus plantarum*, *L. pentosus*, *L. iwatensis*, *L. kunkeei* and *Weissella confusa*.

#### 3.2.4. Microbiological control of probiotics

This contribution is related to the development of methods for assessing probiotic activity. The lack of specific and strict regulation of the process of registration and certification of probiotics in our country is often associated with the low quality of these food supplements. An original procedure for evaluation of the microbiological and functional qualities of the probiotics offered on the Bulgarian market is proposed, which will ensure the exact determination of the composition of these products and thus to realize the necessary control of the probiotic food supplements.

The research and methodological approaches included in this contribution allow an accurate assessment of the quality of probiotic products. It turns out that there is almost no tested probiotic product in our country with satisfactory quality. Significant deviations from the label information on the available strains and the actual composition of the products have been identified. The most common deviations are a smaller number of viable lactic acid bacteria and the presence of unwanted microflora. Most of the species described in the specification are not detected! Most strains found in the tested probiotic supplements have impaired functional properties and do not meet the criteria for probiotic products. The molecular identification proposed in this study is an adequate tool for determining lactic acid bacteria at the species level in food supplements. The

research ends with a recommendation for objective and thorough inspection by the relevant state authorities of all probiotic products on the Bulgarian market according to established and adequate methodology, including requiring proof of the functionality of additives in vivo, which will allow commercialization of probiotic products only with proven efficiency.

#### 3.2.5. Preparation of biologically active substances with antimicrobial action

Marine life is a promising source of antimicrobial proteins with a therapeutic effect. A study of the antimicrobial spectrum of hemocyanin by *Eriphia verrucosa* (warted or yellow sea crab) found that the native hemocyanin expressed in this species has no biological activity. In contrast, five of its glycosylated analogs are effective antimicrobial agents. Of fundamental and practical importance are the results that the fraction with the highest glycan content has the highest antimicrobial efficacy and has the potential to mix some of the antibiotics used today.

#### 3.3. Participation in scientific projects

Assoc. Prof. Dr. Petya Hristova has participated in a total of 32 projects, of which 21 scientific and 11 educational (5 of them international), all of which are in the field of competition. In 7 of them she was a research supervisor (4 at FNI-SU, one thematic with MES, one for a young scientist with MES and one international). Participation in these projects is a guarantee for solid experience in research and design activities. After her habilitation, she participated in or led 12 projects. Only they are calculated in the table for the implementation of the minimum national requirements under Art. 2b of ZRASRB.

#### 4. Teaching experience and classroom employment of Assoc. Prof. Dr. Petya Hristova

The teaching experience of Assoc. Prof. Dr. Petya Hristova is intense and diverse. The report from the last five years shows a constant workload in excess of the required norm of classroom and extracurricular employment, with an average of 448 hours of classroom employment per period. For one academic year, she examines about two hundred students in two main courses "Microbiology", one elective course and another with a master's degree at the department. She has taught in French during academic mobility abroad.

I have known Assoc. Prof. Dr. Petya Hristova for more than thirty years, when we both started our studies at the Faculty of Biology. I would characterize her as a responsible, able-bodied, precise, ethical and well-prepared teacher and researcher. I believe that she will continue to work hard for the prosperity of the microbiological field at the Faculty of Biology of Sofia University "St. Kliment Ohridski".

## Conclusion

Scientific creativity, participation in projects, established citations, significant scientific contributions, participation in national and international conferences, successfully defended under her leadership master and PhD students, as well as the availability of a monography and several textbooks by Assoc. Prof. Dr. Petya Koycheva Hristova fully meet the criteria for "Professor" of the Law for Development of the Academic Staff of the Republic of Bulgaria, the Rules for Application of the Law for Development of the Academic staff of the Republic of Bulgaria and the Rules for the Conditions for Acquiring Scientific Degrees and Holding Academic Positions at Sofia University "St. Kliment Ohridski ". Her teaching activity is intensive and is entirely in the specialty of the competition. This gives me reason to convincingly recommend to the esteemed Scientific Jury to vote FOR the election of Assoc. Prof. Dr. Petya Koycheva Hristova as a Professor in the professional field 4.3. "Biological Sciences", specialty "Microbiology" ("General and Food Microbiology") for the needs of the Department of "General and Industrial Microbiology" at the Faculty of Biology of Sofia University "St. Kliment Ohridski ".

February 29, 2020

Reviewer:

/ prof. Dr. Hristo Gagov /