

R E V I E W

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Regarding: competition for the for the occupation of the Academic position “Professor” in Faculty of Biology, Sofia University “St. Kl/ Ohridski”, in the field of “Natural Sciences, Mathematics and Informatics”, Professional field 4.3 “Biological sciences” (Microbiology - Antibacterial effect of nanomaterials).

General presentation of the documents in the competition

In the competition announced in the State Gazette No. 103 from 12.12.2023 г. for the academic position of "Professor" in the Faculty of Biology at SU "St. Kl. Ohridski" (B.F. at SU) documents were submitted by only one candidate - Associate Professor Dr. Iliyana Atanasova Ivanova from the same Faculty. A set of all the necessary documents was provided to me in an electronic version

Biographical data about the candidate

Iliyana Atanasova Ivanova was born on July 29, 1959 in Stara Zagora. In 1986, she graduated from the "Molecular and Functional Biology" specialty at the Faculty of Biology of the "St. Kl. Ohridski". In 1994, she obtained a PhD in biology after defending a dissertation on the topic: "Microflora of the Tyulenovo oil field and possibilities for its practical application", prepared under the supervision of Assoc. Prof. Veneta Grudeva from the Faculty of Biology at SU "St. Kl. Ohridski".

In the period July 1979 - July 1981, Iliana Ivanova worked as an assistant pharmacist at the Stara Zagora Pharmacy. From September 1986 to October 1988, she was a specialist biologist at the Institute of Genetics of the Bulgarian Academy of Sciences, and from November 1988

to December 1989, she held the same position in the Department of Plant Physiology at the Faculty of Biology, Sofia University "St. Kl. Ohridski". From January 1994 to January 1997, she was an ecologist-biotechnologist at the "Exploration and extraction of oil and gas" enterprise. In February 1997, she joined the Faculty of Biology of Sofia University "St. Kl. Ohridski", where in November 2014, after a successful presentation in a competition, Dr I. Ivanova held the academic position of "Associate Professor".

Project activity

Associate Professor I. Ivanova was a member of the teams of 13 scientific research, educational and scientific applied projects, of which 7 projects were financed by the National Science Fund at the Ministry of Education and Science in Bulgaria, 5 projects were specifically financed by the State Budget, as well as one project financed under Associate Professor I. Ivanova was a member of the teams of 13 scientific research, educational and scientific applied projects, of which 7 projects were financed by the "Scientific Research" Fund at the Ministry of Education and Science, 5 projects were specifically financed by the State Budget, as well as one project financed under Operational Programme "Science and Education for Smart Growth".

Teaching / Educational activity

Assoc. Prof. Iliyana Ivanova is a respected long-time teacher at the Faculty of Biology of the Sofia University "St. Kl. Ohridski", where she participates in the training of students in the programs for the acquisition of the Bachelor's degree (reads mandatory courses in "Microbiology" and "General Microbiology", as well as an elective course "Bioethics") and Master's degree (mandatory courses in "Sanitary Microbiology" and "Physicochemical and biochemical food control"). She also leads courses in the postgraduate qualification programs ("Cell interactions with nanomaterials") and PhD course ("Nanomaterials and interactions with cells").

Dr Ivanova is the supervisor of two PhD students: one of them in April 2019 successfully defended her dissertation for the acquisition of the PhD degree on the topic: "Antimicrobial effect of nanomaterials". The second doctoral student was enrolled in January 2023. Assoc. Prof. Iliyana Ivanova is the supervisor of 24 theses for the acquisition of the Master's degree (17) and the Bachelor's degree (7).

Publishing activity

The candidate in the competition, Associate Professor I. Ivanova, is the author / co-author of 69 publications (37 of which are included in the Scopus database), including 4 book chapters, as well as a dissertation work for the acquisition of the PhD degree and an abstract, monograph and textbook. 8 of the publications are related to her dissertation work, with 37 publications she participated in the competition for Associate Professor, and 24 (22 publications, a monograph and a textbook) she presented in the competition for the academic position of "Professor". The number of citations found at the time of submission of the documents in the databases Web of science and Scopus is more than 160. The total impact factor of Prof. Iliana Ivanova is 31.61, and her H index is 8 (according to Scopus).

After her habilitation, she participated with oral presentations and posters in 33 scientific forums, of which 22 were international and 11 national.

Compliance of the candidate with the minimum national requirements and criteria of the Institute of Biophysics and Biomedical Engineering – BAS for occupation of the academic position “Professor”

The analysis of the materials presented by the candidate, Associate Professor Dr. Iliyana Ivanova, shows that she meets the specified minimum requirements for occupying the academic position "Professor" in the field of “Natural Sciences, Mathematics and Informatics”, Professional field 4.3 “Biological sciences”. The data are summarized in Tables 1.

Table 1. Minimum national requirements and criteria for occupation of the academic position “Professor”

Groups of indicators	Indicators	Required points	Results (Points) achieved by the candidate Iliyana Ivanova
A	1.PhD Thesis	50	50
B	-	-	-
B	Habilitation work - scientific	100	100 Monograph:

	publications in peer reviewed journals indexed in world-famous databases with scientific information (Web of Science and Scopus)		Biological Effects of Nanomaterials, ISBN:978-954-9897-56-2, Amadeus Print, 2022; second edition – University Publishing House, 2023, Sofia, Bulgaria, 204 pages (In Bulgarian)
Г.		200	230
Г7	7. Scientific publications in peer reviewed journals indexed in world-famous databases with scientific information (Web of Science and Scopus).		215* (13 publications in total: 4 in Q2 and 9 in Q3 journals with SJR and /or Impact factor)
Г8	8. Published chapter of a book or collective monograph		15** 1 chapter in a book published by Springer
Д	11. Citations in scientific publications, monographs, collective volumes and patents, referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus).	100	>240 (A List of 165 citations is presented, of which at least 120 are in the period after her habilitation).
Е		150	175
	13. Mentorship to a successfully defended PhD student		25 (1 successfully defended PhD student with 2 supervisors)
	14. Participation in a national scientific or educational project		30 (team member of 3 projects)
	Participation in an		80

	international research project with national co-financing		Participation in 4 such projects
	19. Published university textbook or textbook that is used in the school network		40 Published textbook "Ecotoxicology and Nanotechnology" 2018 Univ. Publisher, 324 pp. ISBN 978-954-07-4402-5
Total		600	>795

*From the Submitted List of Publications I have excluded papers N13 (I did not find data in Scimago about the availability of SJR of the publication for the corresponding year) and N14 (I did not find data about indexing of the journal in Scopus or Web of Science, and the specified ISSN refers to another journal).

**I moved publication N16 to Section Γ8, as it is a chapter from a book by the authoritative Springer Publishers.

Main scientific directions and contributions

The scientific and applied-scientific results and achievements of Associate Professor Iliana Ivanova are in the fields of microbiology and bionanotechnologies.

She participated in the competition for the academic position "Professor" with 22 scientific papers, a monograph and a textbook. They reflect the contributions of the candidate Assoc. Prof. Iliana Ivanova in the following three areas:

1. Original data are obtained on the antimicrobial activity of monometallic, metal oxide and non-metallic newly synthesized nanomaterials (including those prepared on the basis of titanium dioxide, silver, selenium, gold, iron oxide, silicon dioxide, graphene oxide). In the course of the studies, nanomaterials with promising antimicrobial potential (silver, copper, zinc-oxide, niobium, SeNPs) were found in relation to the tested model systems microorganisms *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Bacillus cereus* and two strains of *Escherichia coli*. Graphene oxide nanoparticles have shown effectiveness especially against *B. cereus* NBPMKK1095. The importance of nanoparticle structure and approaches

to their preparation on the one hand and properties of interest for their biomedical application on the other have been illustrated.

2. Prevention of microbial adhesion and biofilm formation. Mainly nanocomposites of nanoparticles embedded on biological (collagen, fucoidan) or chemical polymers (siloxane, graphenes) and combinations between them have been tested.

The promising broad-spectrum antimicrobial activity of some of these materials against Firmicutes (*Staphylococcus epidermidis*, *Bacillus cereus* and *Candida lusitanae*) and Gracilicutes (*Escherichia coli*, *Salmonella enterica* and *Pseudomonas putida*) microorganisms has been demonstrated; it was established that the bactericidal and cytotoxic effect of nanomaterials depends on a number of factors, including the method of synthesis, the starting materials for synthesis, the conditions of production and storage, their structure and size; the type of microorganisms (type of cell wall, optical density of the bacterial suspension and stage of cell development); a cell-specific cytotoxic effect was also found.

The obtained new knowledge and results contribute to a better assessment of the biological activity of nanomaterials, as well as to the optimization of approaches for their preparation. As a result of the conducted interdisciplinary discussions and studies, new anti-adhesive composites to prevent the formation of biofilms have been developed for the first time using fucoidan, antioxidants and siloxane polymers. Of particular interest are materials prepared with fucoidan (a natural biologically active substance derived from brown algae), which has been shown to inhibit bacterial growth on catheters and implants. For the first time, it was found that the inclusion of up to 3–4 wt.% fucoidan in the coatings increased their inhibitory effect, and the inhibition was more pronounced on the Gram-positive bacterium *S. aureus* than on the Gram-negative bacterium *Escherichia coli*. This finding is important because a thicker cell wall gives Gram-positive microorganisms a higher resistance to the antimicrobial action of nanoparticles.

3. Identification of biologically active thin films with antimicrobial activity.

In the study of over 200 different compositions and ratios between the nanoparticles, a synergistic effect of the copper and silver nanoparticles embedded on a titanium dioxide coating and an increase in the antimicrobial effect when replacing the copper nanoparticles with those of silicon dioxide were found. The durability and ease of obtaining these films, including on a large scale, suggests their potential application for the production of antimicrobial film.

Conclusion

The materials presented by Associate Professor Dr. Iliyana Atanasova Ivanova in connection with the competition show that she fully meets the mandatory and specific conditions and scientometric criteria for occupying the academic position "Professor".

With her high professionalism, with her expert, teaching and organizational skills, she has long earned authority as a respected specialist in the national and international scientific space. The original knowledge and results gained by Dr I. Ivanova are a fundamental scientific and scientifically applied contribution in the fields of microbiology and bionanotechnologies and are a step forward towards overcoming important medical and societal challenges, including those related to the antimicrobial resistance of microorganisms.

All this gives me reason to confidently propose to the Scientific Jury and the honorable Faculty Council of the Faculty of Biology of Sofia University "St. Kl. Ohridski" to elect Assoc. Dr. Iliyana Atanasova Ivanova as a PROFESSOR in professional direction 4.3 Biological Sciences (Microbiology-Antibacterial effect of nanomaterials) for the needs of the Department of "General and Industrial Microbiology" in the Faculty of Biology at Sofia University "St. Kliment Ohridski" competition.

09.04.2024.

Sofia

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