REVIEW

On a competition for the academic position PROFESSOR in specialty 4. Natural sciences, mathematics and informatics, Professional direction 4.3 Biological Sciences (scientific specialty *"Biophysics") published* in the State Gazette *no. 63/30.08.2021, declared* for the needs of the Section *"Electro-induced and* Adhesive Properties" at the *Institute of Biophysics and Biomedical Engineering with a single candidate, Assoc.Prof. Biliana Pancheva Nikolova, PhD from IBFMMI - BAS*

Member of the scientific jury (order *No 541/29.09.2021 of the Director of the IBFM):* ***Acad. Alexander Georgiev Petrov***

1. General characteristics of the materials presented. Monographies, articles and reports, textbooks, certificates and patents, research projects, etc. Assess whether the quantitative indicators of the requirements of the IOMT-BAS to occupy the academic position have been complied with. Specify the knowledge-related indicators (total number of articles, articles with impact factor, citations), reduction of articles, etc.

The total number of scientific publications of candidate is 46. Its scientometric data, summarized by group of indicators, are as follows (in brackets are given the minimum requirements according to the Rules of The IBPBMI - BAS):

Group A – 50 (minimum 50)
Group B – 115 (minimum 100)
Group D – 247 (minimum 220)
Group E – 326 (minimum 120)
Group E – 245 (minimum 150)

Thus, the requirements were met and Assoc. Prof. Nikolova was allowed to participate in the competition.

Her Ph D Thesis was defended in IBP-BAS, Sofia (2001). It is based upon 5 papers.

Presented in the contest for "Associate Professor" position were 16 publications (1984 - 1998).

Under present competition, according to the requirements of the law, a separate, habilitation paper is presented, based upon 6 publications in referenced international journals with impact factor (Web of Science and Scopus) in categories Q1 (one publication), Q2 (four publications) and Q3(one publication). The publications went out of print in the period 2013–2021. The habilitation paper is dedicated to the studies carried out and the results obtained by the author in the field of cell electroporation and its antitumor effect. The main approach in the treatment of the respective cancer cell lines is the assisted insertion of the test substances using an electric field. Electroporation has evolved as a biophysical approach to treating almost all types of cells. When applying intensity-appropriate pulses on the surface of cell membranes, temporary pores are formed that facilitate the entry of various antitumor molecules. Redox status and other cellular parameters after treatment with classical antitumor agents and/or newly synthesised anti-tumour/natural origin agents. The paper has the qualities of a dissertation for the highest scientific degree "Doctor of Biological Sciences" and can serve as the basis for successful presentation of such a dissertation.

In the current academic competition, Dr Nikolova has also submitted additional 19 publications from the period 2013-2021. Thus, the total number of her papers for the requested position becomes 25 under this procedure.

The total of 19 (nineteen) publications presented in the competition include: 15 (fifteen) articles in referenced international journals (Web of Science and Scopus), of which

11 (eleven) in impact factor journals, distributed as follows: two publications in category Q1, five in Q2, four in Q3, four in Q4; 4 papers are not referenced or indexed. Citations under the procedure are 163. The H-index of the cited articles is 8.

All these papers are accepted for review. Reducing articles is not necessary.

These science-metric indicators demonstrate the different scientific capabilities of the candidate and convincingly satisfy the requirements of the IBPBMI for the academic position of "Professor".

The candidate has participated and participates in 4 scientific projects, funded mainly by the NFSS and manages 2 such projects. She has participated in 3 projects funded by foreign organizations and leads a Bulgarian team in 1 project. The funds thus obtained amount to BGN 150 000.

2. General characteristic of the scientific, applied and pedagogical activities of the applicant *(scientific fields and problems; supervised PhD students and graduates).*

Biliana Nikolova graduated from Faculty of Biology (Biochemistry and Microbiology), St. Clement of Ohrid University with master's degree (1992). Her working experience is carried out entirely at the Institute of Biophysics and Biomedical Engineering - BAS (former Institute of Biophysics - BAS) as follows: 1992-1994 specialist, 1994-2001 PhD student, 2001 Doctor, 2001-2005 Scientific Assistant II degree, 2005-2013 Assistant General, 2013-present Associate Professor, Head of Section "Electro-Induced and Adhesive Properties". Her present scientific field is electroporation: a biophysical method for transmembrane transfer of nano-sized systems and medicinal products *in vitro and in vivo.*

She has participated with reports in 28 international congresses and conferences and in 15 national congresses, conferences and seminars.

B. Nikolova became an associate professor with electrochemotherapy results, based on electroporation and possessing many advantages over conventional chemotherapy. It is clear that her participation in the competition for professor is based on a new and promising scientific direction.

The objects of her study belong to cell biophysics. Electroporation is an interdisciplinary topic of biophysics, and its study, experimental realization and theoretical description is carried out mainly with the help of models and methods from radiophysics and electronics, and the liquid crystalline approach in the physics of living matter. It is a clearly delineated direction, in which B. Nikolova is a leading researcher.

She was the supervisor of 3 successfully proven master's degrees. She was the supervisor of 1 successfully defended doctoral thesis of the regular PhD student Severina Semkova (2011–2014). She has supervised students under the Operational Program "Human Resources Development" (2007-2013 and 2016).

3. Basic scientific and/or scientific and applied contributions with an assessment of the extent to which they are the personal work of the applicant.

Contributions are largely a result of personal work of the candidate. In many publications she is a leading author. She has active collaborations with leading specialists from abroad. She is invited to give reports at prestigious conferences abroad and has gained high international recognition.

The main contributions are reflected in scientific publications equivalent to habilitation paper **(group of papers 1,** 6 in number) and in those outside the habilitation paper (group of papers **2**, 19 in number).

Scientific contributions, 6 in number, in the **habilitation work 1,** can be summarized as follows: B. Nicolova developed and applied a complex of original procedures for the treatment of pathological cells (tumor, metastatic, psoriasis, etc.) through novel combinations

of electroporation, electro-insertion, electrodeformation, etc. with antitumor agents – biosurfactants (newly isolated glycolipids, ramnolipids, trehalous lipids), phosphocholins, hetero-polysaccharides. Those combinations lead to the maximum specific antitumor effect on cancer cells without damage to surrounding non-tumour cells. The contributions have a markedly effective medical application with a view to using very low concentrations of active substances in combination with electrical pulses.

The **results 2** outside of this work are summarized in a further 10 contributions concerning:

2.1 Electroporation for the treatment of skin tumours in humans
Theranostics with subject of study mouse models and cell lines:
2.2 and **2.**3 Polymersomes based on chemically modified chitozan
2.4 and **2.**5 Nanohydrogels
2.6, **2.**7 and **2.**8 Study of redox status and attitude to cancer treatment
2.9 Synthesis of new antitumor substances
2.10 Examination of isometric contractions of mesenteric arteries

The reviewer supports all these new contributions, and considers that they have the character of:

- Formulation or justification of a new scientific field or problem, new theory or hypothesis:

***contributions 1.** 1 **to 1.** 6;*

- Enriching of existing knowledge and theories:

***2.** 3, **2.** 4 **and 2.** 5;*

-Application of biophysical achievements in biological and medical practice, realized social effect:

***contribution 2.** 1, **contributions 2.** 6 **and 2.** 7; **2.** 8, **2.** 9 **and 2.** 10,*

4. I do not have any special notes and recommendations on the submitted works.

5. Personal impressions of the applicant.

I've witnessed the scientific growth of Dr. Bilyana Nikolova from her habilitation as an associate professor in 2013 (I was a reviewer on her competition). She impresses above all with her in-depth scientific training, with her expert knowledge of the extensive literature in several main disciplines, including biophysics, biochemistry, cell biology, oncology, etc. She demonstrates versatile research-experimenter capabilities, and very good teamwork and team leadership capabilities.

She has given reports at 28 international and 15 national prestigious scientific conferences. She was invited as a reviewer in 10 reputable foreign magazines. Member of scientific juries (with reviews and opinions) for the award of the scientific and educational degree "Doctor", the academic positions "Chief Assistant" and "Professor" in procedures and competitions at IFTT-BAS, IBPBMI-BAS and St. Clement Ohridski University.

6. Reasoned and clearly formulated conclusion (whether she meets the requirements of the Rules of Procedure of IBPBMI - BAS for the academic **position).**

The scientometric data of Assoc. Prof. B. Nikolova meet as a whole and in details the requirements of the IBPBMI for the academic position "Professor".

The scientific papers presented characterize the candidate in this competition Assoc. Prof. Dr. Bilyana Nikolova as a distinguished Bulgarian scientist-biophysicist who presents the Bulgarian biophysics with dignity to the international scientific community.

Given the relevance, importance and international recognition of her scientific contributions, I strongly suggest Associate Professor Dr. Bilyana Nikolova to be promoted to the academic position of Professor in the professional field 4.3 Biological Sciences, in the scientific specialty "Biophysics".

15.11.2021.

Signed: Acad. Alexander Georgiev Petrov