

REVIEW

From **Prof. Rumiana Atanasova Bakalova-Zheleva, PhD, DSci**

Department of Physics, Biophysics and Radiology, Medical Faculty, Sofia University
“St. Kliment Ohridski”

Regarding the “**Professor**” competition in 4. „Natural sciences, Mathematics and Informatics”, professional field 4.3. „Biological Sciences”, scientific specialty
„**Biophysics**”,

Announced in the State Newspaper, issue 41/21.05.2019 r., for the needs of the Institute of Biophysics and Biomedical Engineering (IBPBME) of the Bulgarian Academy of Sciences (BAS)

1. Common part

The competition was announced for the needs of the section "Biomacromolecules and Biomolecular Interactions" at the IBPBME of BAS. The only candidate in the competition is Assoc. Prof. Sashka Boychova Krumova, PhD from the same section. The submitted documents show that the procedure for opening and announcing the competition has been followed the rules described in the law. The documents have been prepared in accordance with the requirements of the Act of the Development of the Academic Staff in the Republic of Bulgaria (ADASRB) and the Regulations for its implementation.

2. Biographical details of the applicant

Assoc. Prof. Sashka Krumova was born on December 11, 1977 in Bulgaria. In 2001, she completed her master's degree at the Faculty of Biology at Sofia University “St. Kliment Ohridski”, Sofia, Bulgaria, specialty “Biotechnology”, specialization “Molecular biotechnology”. Specializations abroad: 2001-2002 – Hungarian Academy of Sciences, where she graduated from the “Advanced Biophysics School on Lipid-Protein Interactions and the Organization of Membranes”; 2004 and 2008 – University of Wageningen (Netherlands), where she completed the following courses: “EPS Course Advanced ESR Spectroscopy in Membrane Biophysics”, “Personal Competence Assertiveness, Time Management and Project Planning”.

In the period 2001-2006, she developed and successfully defended her PhD thesis in "Biophysics". The studies have been conducted in the Institute of Biophysics of BAS and the Institute of Plant Biology of the Hungarian Academy of Sciences (Szeged, Hungary). The PhD thesis title is: "Temperature stability of pigment-protein complexes in thylakoid membranes from higher plants: Thermo-optical effect". The following are

two courses abroad as a post-doctoral student in the Maria Curie program "From FLIM to FLIN": February 2008 – Czech Academy of Sciences (Czech Republic), "Modern methods in computational chemistry, synthetic organic chemistry and fluorescence spectroscopy"; June 2008 – University of Wageningen (Netherlands), "Time-resolved microspectroscopy in the life science".

Assoc. prof. Sashka Krumova has held the following academic positions: Specialist (2005-2007) at the Hungarian Academy of Sciences (Szeged, Hungary); Specialist and Chief Assistant (2009-2010 and 2010-2013) at the IBPBMI of BAS; From March 2013 until now she is an Associate Professor (full-time, permanent staff) at the IBPBMI of BAS.

Assoc. Prof. Krumova has over 10 years of academic experience. She speaks three foreign languages: English, German and Spanish.

3. Overview of scientific activities

The reference for the fulfillment of the minimum national requirements for occupation of the academic position of "Professor", as well as the requirements, specified in the Rules for the implementation of ADASRB in the IBPBMI of BAS show the following:

Criteria A: 50 points

Criteria B (optional): 0 points

Criteria C: 135 points

Criteria D: 305 points

Criteria E: 274 points

Criteria E: 257 points

This includes:

- (1) Habilitation thesis entitled: "Calorimetric markers for the detection and monitoring of patients diagnosed with multiple myeloma". The data described in the thesis are published in 8 scientific journals with a total impact factor of 17.35.
- (2) A book published on the basis of PhD thesis (2009).
- (3) Scientific publications outside the habilitation thesis in journals with impact factor – 13 in total, 4 of them in Q1, 3 in Q1/Q2, 4 in Q2/Q2, 2 in Q3. The total impact factor of publications is 34.05.
- (4) At the moment, 137 citations from foreign authors have been noticed for the period after the acquisition of the academic position of Assistant Professor.
- (5) Participation in 15 national scientific and educational projects, as in 2 of them being a project leader.

(6) Participation in 4 international scientific and educational projects.

(7) Advisor/supervisor of one PhD student (successfully defended).

The scientific papers submitted by Assoc. Prof. Sashka Krumova in this competition do not overlap with those used for the acquisition of the academic position "Associate Professor". All the works of the candidate are related to the profile of the current competition.

4. Scientific contributions of the applicant in the field of Biophysics

The scientific studies of Assoc. Prof. Sashka Krumova relate in general to the biophysical characterization of biological objects with different degree of complexity and the mechanisms of their functioning. Studies are on soluble and membrane-bound proteins and pigment-protein complexes, both in isolated systems and in their native environment. The results of her experimental studies contribute to clarify the structure-function relationship at different levels of structural organization of biomacromolecules and can be summarized in the following directions:

- (1) Structural stability of pigment-protein complexes constituting the photosynthetic apparatus of higher plants and cyanobacteria; the role of their structural organization in the efficiency of photosynthesis; effect of exogenous and endogenous growth regulators on the photosynthetic activity of these complexes.
- (2) Relationship between structural stability of major protein components (hemoglobin, cytoskeletal proteins and plasma membrane proteins) and changes in erythrocyte morphology during cell aging.
- (3) Temperature stability, conformation and intermolecular interactions of major serum proteins in haematological pathologies; calorimetric markers for the diagnosis and monitoring of multiple myeloma.
- (4) Calorimetric characteristics of cancer cells/nuclei.
- (5) Energy aspects of the interaction of thymidylate synthetase ThyX with the cofactor FAD and the substrate deoxyuridine monophosphate.

In accordance to the habilitation thesis, 5 major scientific contributions have been defined. Some of which I consider to be of particular interest and application potential for biomedical practice:

- (1) Specific calorimetric markers for multiple myeloma have been identified that differentiate it from other hematologic and cancerous diseases.
- (2) A unique calorimetric characteristic of destabilized monoclonal free light chains has been established – with endothermic transition at 47 °C, which is

accompanied by the formation of amorphous aggregates of these proteins.

(3) The changes in blood serum thermograms have been found to correlate with the clinical status of patients and their treatment, which is of great importance especially in patients with non-secretory myeloma, where diagnosis and monitoring rely on invasive techniques.

Outside the habilitation work, 5 original scientific contributions have been defined:

- (1) Specific structural changes have been identified in the photosystem complexes of photosystems 1 and 2, related to the processes of photoprotection in higher plants.
- (2) Development of calorimetric approach to investigate the structural stability of light-harvesting complexes in cyanobacteria in intact cells of *Synechocytis* sp. PCC 6803.
- (3) The role of exogenous growth factors for the structural organization and function of the photosynthetic apparatus in higher plants has been demonstrated, leading to high photosynthetic activity and the accumulation of important secondary metabolites such as polyphenols and flavonoids.
- (4) Investigation of the potential of differential scanning calorimetry method for the diagnosis of diseases based on the thermodynamic properties of: (a) the plasma proteome in schizophrenia; (b) normal and cancerous cell lines.
- (4) Various factors for the stabilization and destabilization of the tetramer soluble proteins of thymidylate synthase and hemoglobin have been characterized.

Prof. Sashka Krumova also described her views on future research in three advanced areas:

- (1) Investigation of the role of carbon-based nanomaterials on the structural and functional features of the photosynthetic apparatus.
- (2) Interactions of 2D nanomaterials (graphene and its derivatives) with plasma proteins, cells and membrane layers.
- (3) Characterization of the mechanisms of erythrocyte aging in different pathologies.

The high impact factor of the journals in which the papers were published (mainly in Q1 and Q2), as well as the high number of citations in a relatively short time indicate the high quality and originality of her studies.

5. Expert and organizational activities

The documents submitted show that Assoc. Sashka Krumova is a Scientific Secretary of the IBPBMI since March 2019, which is an acknowledgment of her professional and organizational abilities.

CONCLUSION

Since the beginning of her scientific career, Assoc. Prof. Sashka Krumova has been working in the field of Biophysics. During her education and professional carrier, she has gained an excellent experience and has generated original scientific ideas. All her experimental and theoretical studies are closely related to the topics of the section "Biomacromolecules and Biomolecular Interactions", for the needs of which the current competition is announced.

The scientific activities of Dr. Krumova completely cover, and in some of the criteria exceed the minimum national requirements for occupying the academic position of "Professor", as well as the requirements, specified in the Regulations for the implementation of ADASRB in the IBPBMI of BAS. Assoc. Prof. Sashka Krumova is definitely a scientist, very good researcher and manager in science, as evidenced by the numerous scientific projects in which she has participated and is currently involved.

Based on the mentioned above, I strongly recommend Assoc. Prof. Sashka Boychova Krumova to be awarded with the academic position of "Professor", in the professional field 4.3. "Biological Sciences", scientific specialty "Biophysics".

Reviewer:

Prof. Rumyana Atanasova Bakalova-Zheleva, Ph.D.

09/22/2019