

OPINION

Regarding the competition for the academic position Associate Professor in the field of higher education 4. Natural Sciences, Mathematics and Informatics, scientific direction 4.3.

Biological Sciences, scientific specialty Biophysics for the needs of Transmembrane Signaling Laboratory at Institute of Biophysics and Biomedical Engineering at Bulgarian Academy of Sciences,

announced in the issue 58/18.07.2025 of State Gazette

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Member of the Scientific jury, appointed by the order № 632/01.08.2025

of the Director of IBPhBME, BAS

In the present competition for the academic position Associate Professor in the scientific direction 4.3. Biological Sciences, scientific specialty Biophysics, only one scientist applied, Senior Assistant Dr. Sonya Nikolova Apostolova. Sonya Apostolova obtained a Bachelor's degree in Molecular Biology in 2011, and in 2013 – a Master's degree in Virology at the Faculty of Biology of Sofia University "St. Kliment Ohridski". During her studies for Master's degree, Sonya Apostolova was appointed as a technician at the Institute of Experimental Morphology, Pathology and Anthropology with a Museum, BAS, where she accomplished the Master thesis, and in 2014 Sonya Apostolova was appointed as a technician at the Institute of Biophysics and Biomedical Engineering, BAS. In 2015, she obtained a PhD scholarship from the University of Lleida and the Biomedical Research Institute Lleida (IRB Lleida), Lleida, Spain. In 2021, Sonya Apostolova defended her doctoral thesis with distinction (Cum Laude) on the topic "The RING domain of Nse1: roles in Smc5/6 complex stability and genome integrity in human cells". Supervisors of the thesis were Assoc. Prof. Dr. Jordi Torres Rosell and Assoc. Prof. Dr. Neus Colomina. During her PhD fellowship, Sonya Apostolova was accepted for a research internship in the Signaling and Checkpoints of Cell Cycle at the Faculty of Medicine at Barcelona University, Spain. In 2021 Dr. Apostolova has been promoted as a Senior Assistant at the IBPhBME, BAS.

Dr. Apostolova is a co-author of 21 scientific articles, 16 of which are in scientific journals referenced in SCOPUS and Web of Science, 3 in Reports of the Bulgarian Academy

of Sciences and 2 in materials of a conference proceeding. The published articles have been cited 84 times, which is an indication of the relevance of her research. The h-index by SCOPUS after excluding self-citations is 5. Dr. Apostolova has been a member of the research team of 8 national and 5 international scientific projects, and has been the principal investigator of a project funded by the Ministry of Education and Science – the National Program "Young Scientists and Post-Doctoral Students-2". Dr. Apostolova possesses as well a teaching experience, gained through conducting laboratory exercises of students in Immunology and Tissue Engineering at the University of Chemical Technology and Metallurgy in Sofia. Dr. Apostolova is a holder of three scholarships in Spain and Italy and obtained two awards for best poster.

In the documents applied for the current competition for Associate Professor Dr. Apostolova included 15 articles, of which 13 with IF and two with SJR. According to the ranking of scientific publications by quartiles, the published articles are as follows: 8 in journals with Q1, 4 – with Q2 and 3 – with Q3. In three of the publications Dr. Apostolova is the first author, which indicates her significant contribution. The total IF of the published articles, included in the competition, is 40.07. It is worth noting that four of the published articles are in journals with IF above 4.

A completed certificate for the fulfillment of the minimum national requirements under Art. 2b of the Law on the Development of the Academic Staff of the Republic of Bulgaria in the field of higher education 4. Natural Sciences, Mathematics and Informatics, scientific direction 4.3. Biological Sciences, scientific specialty Biophysics for the academic position Associate Professor. According to indicators G and D, are presented more than the required points.

A detailed reference of the scientific contributions is attached, in which the main achievements are presented, some of which represent new scientific facts.

The research interests of Dr. Apostolova's are focused on investigation of the anti-tumor activity of natural and synthetic substances in human *in vitro* cell models, monitoring the biocompatibility of various materials for the purposes of tissue engineering and regenerative medicine as well as the application of different approaches for the treatment of diabetic neuropathy. The scientific achievements of Dr. Apostolova are arranged into three main sections:

- I. Investigation of anti-tumor activity and anti-metastatic potential of new natural and synthetic molecules in human *in vitro* cell models
- II. *In vitro* study of the biocompatibility of various materials for the purposes of tissue engineering and regenerative medicine
- III. Application of various therapeutic approaches for the treatment of diabetic neuropathy and study of the impact of melatonin deficiency in the aging process in *in vivo* model

The **first section** includes research aimed at the development and implementation of new anti-tumor drugs and therapeutic strategies that provide effective anti-tumor protection and are minimally invasive to normal cells. Special attention is paid to biologically active substances of plants and to propolis, which is rich in phenols and flavonoids. It has been established that a standard extract of the butterbur (*Petasites hybridus* L.), containing the biologically active substance pentasins and purified from pyrrolizidine alkaloids, acts selectively as a pro-oxidant in human invasive breast cancer cells MDA-MB231 and as an antioxidant in normal mammary epithelial cells MCF10-A. It has been supposed that the oxidative stress and induced apoptosis in metastatic cancer cells after treatment with the extract of the butterbur is most likely due, at least in part, to the activation of the NF- κ B signaling pathway, inducing an irreversible process of late apoptosis. It has been shown that samples from propolis from three different regions of central Bulgaria reduce the proliferation of invasive breast cancer cells, with the degree of antiproliferative activity correlating with higher antioxidant activity and higher content of phenols and flavonoids. The results obtained regarding the potential of biologically active substances from plants and propolis could be of interest in developing a strategy for application in the therapy of metastatic breast cancer.

Another group of research is focused on increasing the water solubility and absorption of various biologically active substances with anti-tumor potential by modification with ionic liquids. It has been shown that the cytotoxicity of the highly hydrophobic botulinic acid, isolated from the bark of white birch (*Betula* spp.), was significantly increased after modification with various polar, nonpolar or charged ionic liquids based on amino acids, with the strongest cytotoxic effect observed upon modification with the polar amino acid lysine. It was also reported that hemocyanin, modified with choline-based ionic liquids, demonstrated stronger antiproliferative activity in breast cancer cells, most likely as a result of induced

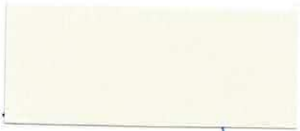
structural changes, which induces specific interaction with the membranes of cancer cells. The possibility of enhancing the cytotoxicity of hydrophobic anti-tumor drugs by incorporating into newly synthesized fluorescent nano micelles was also investigated. It was shown that the drug erufosine, used in the treatment of parasitic diseases, leads to disruption of cytoskeletal integrity and induction of apoptosis in invasive myeloid tumor cells.

The **second section** includes research focused on determining the *in vitro* biocompatibility of natural and synthetic materials, suitable for application in biomedical practice for wound healing, regeneration of damaged blood vessels, bone implants, etc.

The **third section** summarizes studies on the effect of riboflavin and liraglutide in alleviating diabetic neuropathic pain, as well as the antioxidant activity of melatonin in the aging process in an *in vivo* rat model.

In conclusion, I am convinced that Dr. Sonya Apostolova participates in the announced competition for the academic position of Associate Professor with sufficient quality of scientific achievements and contributions that exceed the Minimum National Requirements for acquiring the academic position of Associate Professor laid down in the Law on Development of the Academic Staff of the Republic of Bulgaria, as well as the specific requirements in the Regulations for its application approved by the Scientific Council of the IBPhBME for the field of higher education 4. Natural Sciences, Mathematics and Informatics, scientific direction 4.3. Biological Sciences, scientific specialty Biophysics. The scientific interests of Dr. Apostolova are focused in the topic of the Transmembrane Signaling Laboratory at IBPhBME. I believe that the promotion of Senior Assistant Dr. Sonya Nikolova Apostolova as Associate Professor for the needs of the Transmembrane Signaling Laboratory at IBPhBME–BAS is appropriate and recommended.

11.11.2025 г.

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/Prof. Antoaneta Popova/