REVIEW

by Assoc. Prof. Dimitar Borisov Iliev, PhD, Institute of Molecular Biology – Bulgarian Academy of Sciences

for the competition for occupying the academic position "Associate Professor" in Higher Education Area 4. "Natural Sciences, Mathematics and Informatics", Professional Field 4.3. "Biological Sciences", Scientific Specialty "Biophysics" for the needs of the "Transmembrane Signaling" Laboratory at the IBPhBME–BAS

This review has been prepared in accordance with the decision of the First Meeting of the Scientific Jury, approved by the Director of IBPhBME–BAS by Order No. 632/01.08.2025, according to the decision of the Scientific Council (Minutes No. 12/01.08.2025), and in accordance with Article 25 of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), regarding the announced competition for "Associate Professor" in Higher Education Field 4: "Natural Sciences, Mathematics and Informatics," Professional Field 4.3: "Biological Sciences," Scientific Specialty "Biophysics," for the needs of the laboratory "Transmembrane Signaling," announced in State Gazette, Issue 58/18.07.2025.
The First Meeting of the Scientific Jury was initiated by the Director of IBPhBME–BAS by Order No. 761/19.09.2025. At the meeting I was assigned to prepare a review for the procedure.

The competition has one candidate – Senior Assistant Sonya Nikolova Apostolova, PhD.

The documents submitted by Dr. Apostolova comply with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and with the Rules for the Development of the Academic Staff of BAS, and meet the criteria of IBPhBME–BAS for acquiring the academic position of "Associate Professor." According to the summary presented in Table 1, the candidate fully covers the minimum required points for the position of "Associate Professor" in groups A and B, while in groups C and D the number of submitted points exceeds the required minimum. The total number of points presented by the candidate is 463, with 430 required.

Table 1. Minimum required points by indicator groups for the academic position "Associate Professor":

Indicator Group	Minimum Required	Submitted by Candidate
А	50	50
Б	100	100
Г	220	225
Д	60	88
Общо	430	463

Education

Senior Assistant Sonya Nikolova Apostolova, PhD, completed her higher education at Sofia University "St. Kliment Ohridski," where she obtained a Bachelor's degree in Molecular Biology, followed by a Master's degree in Virology.

In 2021, Dr. Apostolova defended her doctoral dissertation at the University of Lleida, Spain, on the topic:
"The role of NSE1 RING domain in the stability of Smc5/6 complex and genome integrity in human cells."
The dissertation, awarded the highest distinction *Cum Laude*, reflects substantial experimental work and contributes to understanding the mechanisms responsible for maintaining genome stability in human cells.

Professional Experience

After returning to Bulgaria, Dr. Apostolova joined the Institute of Biophysics and Biomedical Engineering – BAS (IBPhBME–BAS), in the laboratory "Transmembrane Signaling," under the supervision of Prof. Rumyana Tzoneva, PhD. She holds the position of Senior Assistant and actively participates in scientific research projects of both fundamental and applied nature.

Her research activity is interdisciplinary, covering molecular biology, biophysics, cell biology, and studies of biocompatible materials.

Publication Activity

Dr. Apostolova's scientific output is impressive and fully meets the criteria for the academic position of "Associate Professor."
She is co-author of **21 publications**, 15 of which are included in the competition materials, with **13 in impact factor journals** and **2 in SJR-ranked journals**.
Her total impact factor is **40.068** and her **h-index is 5**.

She is first author on three publications and a lead experimentalist or corresponding author on others, demonstrating both active and leading roles in the research.

Her work has been published in reputable international journals such as *Cell Reports*, *Cellular and Molecular Life Sciences*, *Colloids and Surfaces B: Biointerfaces*, *Frontiers in Pharmacology*, among others.

Her publications cover several thematic areas:

1. Antitumor and anti-proliferative activity of natural and synthetic compounds;

2. Biocompatibility and nanostructured materials for tissue engineering applications;
3. Molecular mechanisms of cellular signaling in aging and neurodegeneration.

These studies demonstrate methodological rigor, strong statistical support, and originality.

Citations

As of the submission of her documents, Dr. Apostolova's publications have received **84 independent citations**, confirming the impact and international visibility of her research. Citations in prestigious journals further attest to its scientific significance.

Participation in Research Projects

The candidate has extensive project activity:

- Participation in **8 national** and **5 international** scientific projects funded by BAS, the Ministry of Education and Science, and European programs;
- Principal investigator of a project under the National Program "Young Scientists and Postdoctoral Researchers," through which she develops an independent research line on new biocompatible carriers for antitumor agents;
- Engagement in international collaborations with research groups from Spain, Germany, and Italy, demonstrating strong integration into the international scientific community.

Awards and Scholarships

Dr. Apostolova has received academic honors and scholarships for high achievement during her doctoral studies and international research activity.
Her work has been recognized at youth scientific forums and national conferences, reflecting strong professional acknowledgment.

Conference Participation

The candidate has presented her research at **18 scientific conferences** – 12 national and 6 international, including 7 oral presentations and 11 posters.

Scientific and Applied Contributions of the Candidate

Dr. Apostolova's scientific activity can be grouped into three main areas with clearly defined contributions:

I. Investigation of Antitumor Activity and Anti-metastatic Potential of New Natural and Synthetic Molecules in Human *In Vitro* Cell Models

Significant results have been achieved regarding:

- Antitumor effects of natural extracts such as *Petasites hybridus* and propolis, demonstrating cytotoxicity toward breast and prostate cancer cells;
- Study of amino acid ionic liquids as carriers of active substances (e.g., betulinic acid, hemocyanin), enhancing their bioavailability and selectivity;
- Development of nano-micellar systems for controlled delivery of hydrophobic antineoplastic agents;
- Repurposing existing drugs (e.g., erufosine) for new antitumor applications.

These results have strong potential for practical application in modern oncology and represent an excellent example of knowledge transfer between fundamental and applied science.

II. *In Vitro* Evaluation of Biocompatibility of Various Materials for Tissue Engineering and Regenerative Medicine

Dr. Apostolova has contributed to the development and characterization of hybrid biocompatible materials for tissue engineering, including:

- Gelatin matrices with silver nanoparticles;
- Hydrogels with antimicrobial and angiogenic properties;
- 3D biomaterials promoting cell adhesion and proliferation.

These developments have direct application potential in regenerative medicine and implantology and demonstrate a successful link between biophysics and biomedical engineering.

III. Application of Therapeutic Approaches for Treating Diabetic Neuropathy and Investigation of Melatonin Deficiency in Aging Using *In Vivo* Models

In this area, she has examined:

- Antioxidant and neuroprotective effects of riboflavin and liraglutide in diabetic neuropathy models;
- The role of melatonin deficiency in sphingolipid signaling during aging and neurodegeneration.

These findings may serve as a basis for future studies confirming the connection between melatonin deficiency and sphingolipid metabolism in aging, and for developing melatonin-based preventive approaches. The studies contribute to better understanding metabolic stress, cellular homeostasis, and new therapeutic perspectives for age-associated diseases.

Recommendations

It is advisable that in the future Dr. Apostolova further enrich her academic career with teaching activities and supervision of M.Sc. and doctoral students.

Conclusion

In conclusion, Senior Assistant Sonya Nikolova Apostolova, PhD, meets all requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Rules for its implementation at IBPhBME–BAS, and stands out as a highly qualified and independent researcher with significant contributions in biophysics, cell biology, and biomedical engineering.

Her research demonstrates innovation, experimental precision, and the ability to apply modern methods for analyzing cellular processes and biomaterials. Her publication activity, participation in national and international projects, and recognition by the scientific community attest to her stable and growing scientific maturity.

Dr. Apostolova shows excellent potential for development as a leading researcher, possessing initiative, competence, and qualities fully in line with the criteria for the academic position of "Associate Professor" within BAS.

Based on the submitted materials, scientific contributions, and overall research activity, I express a firm positive evaluation and recommend that Senior Assistant Sonya Nikolova Apostolova, PhD, be elected **Associate Professor** in Professional Field 4.3. Biological Sciences, Scientific Specialty "Biophysics," at the Institute of Biophysics and Biomedical Engineering – BAS.

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Prepared by:

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