

OPINION

By Prof. Biliana Pancheva Nikolova, PhD

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According to a competition for the academic position "Associate Professor" in the field 4.3. Biological Sciences, scientific specialty "Biophysics", announced in the State Gazette, issue 58/18.07.2025 for the needs of the Institute of Biophysics and Biomedical Engineering - BAS, section "Electroinduced and Adhesive Properties".

With a single candidate who has submitted documents for participation: Dr. Kamelia Todorova Hristova-Panusheva, Chief Assistant Professor in the section "Electroinduced and Adhesive Properties" of the Institute of Biophysics and Biomedical Engineering - BAS.

By order of the Director of the Institute of Biophysics and Biomedical Engineering - BAS, I am appointed as a member of the scientific jury in the above-described competition.

At the first meeting of the scientific jury, we reviewed in detail the materials provided by Dr. Kamelia Todorova Hristova-Panusheva and established that they meet the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria and the regulations of the Institute of Biophysics and Biomedical Engineering - BAS.

1. General information about the candidate

The competition is attended by Dr. Kamelia Todorova Hristova-Panusheva, Chief Assistant Professor in the Section "Electroinduced and Adhesive Properties" of the Institute of Biophysics and Biomedical Engineering - BAS. The submitted materials reflect her many years of research and teaching activity in the field of nanobiophysics, cell interactions and biomaterials.

2. Research activity and main directions

The scientific work of Dr. Hristova-Panusheva is characterized by exceptional multidisciplinary nature, combining approaches from biophysics, nanotechnology, cell biology and biomaterials engineering. Her main contributions are in the following areas:

1) Photothermal anticancer therapy – systematic study of the effects of the combination of graphene oxide and gold nanoparticles with laser irradiation (in the near infrared and femtosecond region). Increased biocompatibility and reduced toxicity of pegylated graphene oxide (GO-PEG) were found; a synergistic photothermal effect leading to enhanced apoptosis and suppression of metastatic genes; as well as selective cytotoxicity to cancer cells while preserving the viability of normal cells. These results have high applied value for the development of personalized anticancer therapies.

2) Biocompatible materials and tissue engineering – new composite coatings based on hexamethyldisiloxane (HMDS) and detonation nanodiamond (DND), as well as multilayer

TiN/TiO₂ structures were developed. The relationship between elasticity, hydrophilicity and cell adhesion was studied. It has been found that plasma modification and incorporation of nanodiamonds can achieve optimal surface properties for osteogenic differentiation of mesenchymal stem cells.

3) Cell adhesion and signaling pathways – the effect of the inhalation anesthetic halothane on focal adhesion proteins in lung cells (A549) has been elucidated, as well as the mechanisms of action of plant cystatins (dgECP1 and dgECP1m1) on cancer and normal breast cells. The results obtained show potential for modulating cell adhesion and limiting metastasis.

4) Mitochondrial functions and nanoparticles – the interactions between aminated graphene oxide (GO-NH₂) and cellular/mitochondrial systems have been studied. It has been shown that modification with ammonia changes the charge, morphology and toxicity of the particles, leading to cell-specific effects on ROS production and ATPase activity.

5) Biocompatibility of plant extracts – the safety of a total ethanol extract of *Haberlea rhodopensis* on human embryonic cells has been proven, which opens up prospects for application in cosmetics and antioxidant therapy.

3. Scientific contributions and originality

Dr. Hristova-Panusheva's works contain a significant number of original results, published in renowned international journals and cited by Bulgarian and foreign authors. Her main contributions can be summarized as follows:

- Introduction of new nanocomposite systems for photothermal therapy and tissue engineering.
- Experimental evidence of the synergistic effect of laser irradiation and nanoparticles on cancer cells.
- Clarification of the relationship between the surface and mechanical properties of biomaterials and cell adhesion and differentiation.
- Evidence of high biocompatibility and potential therapeutic applicability of plant bioproducts.
- Contribution to the mechanistic understanding of the toxicity of nanomaterials at the cellular and subcellular level.

4. Project activity

Dr. Hristova-Panusheva actively participates in research projects. Her work is distinguished by a high experimental culture, methodological precision and skill for interdisciplinary cooperation.

5. Conclusion

The presented habilitation production demonstrates mature scientific thinking, consistency and originality. The results of Dr. Kamelia Hristova-Panusheva have a clearly expressed contribution and applied nature in the field of biophysics, nanomedicine and biomaterials. They fully meet the criteria of the Bulgarian Academy of Sciences for occupying the academic position of "associate professor".

Recommendation

Based on the submitted materials, scientific contributions and personal qualities of the candidate, I express a positive opinion and strongly recommend to the scientific council of IBFBMI-BAS that Dr. Kamelia Hristova-Panusheva be elected as an "associate professor" in the scientific specialty "Biophysics" (field 4.3. Biological Sciences).

Date. 03.11.2025

Signature:


Prof. Biliana Pancheva Nikolova-Lefterova
IBBFBMI – BAS
