

OPINION

by Prof. Anelia G. Dobrikova, PhD
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Regarding the competition for the academic position “Associate Professor”,
announced in the State Gazette No. 32/26.04.2022
Professional field: 4.3. Biological Sciences
Scientific specialty: Biophysics

Member of the Scientific Jury according to Order No. 304/30.05.2022
of the Director of IBPhBME-BAS

For participation in the announced competition for the academic position "Associate Professor", for the needs of the Department "Lipid-Protein Interactions" at the Institute of Biophysics and Biomedical Engineering – BAS, only one candidate has submitted documents: **Senior Assist. Prof. Aneliya Stefanova Kostadinova, PhD**. The documents presented by the applicant for participation in the competition are in full accordance with the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ADASRB) and the Regulations for its implementation at IBPhBME - BAS.

Short biography of the applicant

Aneliya Kostadinova received her master's degree in Cell Biology and Developmental Biology from the Faculty of Biology at the Sofia University “St. Kliment Ohridski” in 1993. In 1995, she entered the Institute of Biophysics - BAS as a biologist, then in 2003 she was appointed as an Assistant Professor in the same Institute. Since February 2011 (according to reference from NACID) she has been a Senior Assistant Professor in the restructured Institute of Biophysics and Biomedical Engineering - BAS. In December 2011, Anelia Kostadinova defended her doctoral dissertation on the topic: “Modulation of the interaction of cells with polymer surfaces and membranes” to receive the educational and scientific degree “Doctor” (PhD) in the scientific specialty "Biophysics" at the IBPhBME - BAS.

Since 2004, she has been running lectures and exercises at the Faculty of Biology at the Sofia University “St. Kliment Ohridski” on biochemistry, cell biology, cytology and cell cultures. During the period 1996 - 2005, Anelia Kostadinova was on several specializations at GKSS Research Center, Institute of Chemistry, Teltow, Germany.

Research activities of the applicant

Senior Assist. Prof. Aneliya Kostadinova has a total of 41 scientific publications, 25 of which are referred in Scopus, 1 book chapter and another 15 articles that are not indexed in Scopus/WoS (an additional bibliography is provided for them). According to Scopus (September 2022), they have been cited (without self-citations) over 127 times with *h*-index: 5 (without self-citations).

For the announced competition, she participates with a total of 18 scientific publications, 11 of which are in reputed journals with an impact factor (ISI IF), 6 are with an SJR and 1 book chapter (*MedDocs Publishers*); 5 of them are with rank Q1, 4 with Q2, 8 with Q3 (according to www.scimagojr.com). In the presented list of publications for the competition, the IF of one publication was not reported: No. G7-5. I would like to note that in 9 of the presented publications Anelia Kostadinova is the first author. A reference list with 32 citations in Scopus was also presented for the competition. All this suggests the high quality of the scientific publications, as well as the personal participation of the candidate in them.

These scientific activities fully meet the requirements of the ADASRB and the regulations for its implementation at IBPhBME-BAS for the academic position "Associate Professor" and cover the minimum required points for all groups of indicators, as follows: B-105, G- 235, D- 64.

All publications presented for the competition reflect significant interdisciplinary research in the fields of biochemistry, chemical engineering, tissue engineering, biophysics, nanomaterials, etc. They are the result of collaboration with several national and international scientific groups from the Faculty of Biology at the Sofia University, UCTM, Luxembourg Institute of Science and Technology, Nanotechnology and Advanced Materials Central Lab., and Agriculture Research Center, Egypt, etc.

According to the submitted documents, Dr. Anelia Kostadinova has participated in a total of 19 research projects, and she has been a leader of 1 international project with Egypt. Dr. Anelia Kostadinova has been a research supervisor of 4 diploma theses of students from the Sofia University. She also conducted training for students from the Sofia University under the program "Student Practices". A list of 27 participations in scientific conferences is also presented.

Scientific topics and contributions of the publications:

The scientific results and original contributions of the publications of Senior Assist. Prof. Aneliya Kostadinova, presented for the competition, are described in the Extended Habilitation Report. They are relevant and interesting from both fundamental and applied viewpoints for the modern biomedicine.

The scientific topics can be divided into three main groups:

1. Establishing the interaction of different types of cell lines with synthetic or natural materials, as well as with nanomaterials (nanoparticles) for application in biomedicine. These studies are of fundamental importance to establish the mechanisms of changes occurring in the cell membrane through different signaling molecules and pathways that influence cell complexes and cell physiology.
2. Revealing the mechanisms of cell membrane interactions with amphiphilic molecules of natural or synthetic origin. These studies are of a scientific-applied nature, aiming to investigate the potential antitumor action of these molecules in *in vitro* model systems. Techniques potentiating their entry into the cell, such as electroporation, have been applied.
3. Establishing lipid-protein and lipid-lipid interactions in cells by studying model membranes and cell models. The influence of oxidized lipids on the lipid arrangement and membrane organization, as well as the behavior of some membrane proteins has also been established.

The main scientific contributions of these studies are briefly summarized in 2 main groups as follows:

1. Contributions of a fundamental nature in relation to the interaction of human cells with synthetic or natural materials, as well as with nanomaterials (nanoparticles). (No. B4-1, B4-2, G7-1, G7-7, G7-8, G7-9, G7-10, G7-11, G7-12, G8-1):
 - The surface hydrophobicity has been found to influence the organization of integrin receptors and focal adhesion contacts in fibroblasts, which play a crucial role in tissue compatibility of biomaterials. The applied research techniques enable a complex evaluation in the study of the tissue compatibility of the newly synthesized materials and can be useful in the development of new biomaterials with precisely defined composition and properties.

- The biocompatibility of synthetic membranes and poly fibrous scaffolds (PDMS-b-PAA by electrospinning) has been shown to be affected by roughness (pore size, fiber homogeneity), charge and length of polymer chains. It has been established for the first time that the interaction of cells with modified polyethyleneglycol surfaces depends on the length, structure and density of the polymer chains, as well as the presence of COOH groups.

- The functionalization of nanomaterials containing metal ions or graphene oxide has been found to improve their antibacterial properties and lead to specific and adjustable activity towards eukaryotic cells. Molecular mechanisms of interaction of chitosan with the main lipid classes and their phase state have been proposed. New antimicrobial biomaterials from collagen/zinc titanate ($ZnTiO_3$) have been developed using sol-gel cryogenic drying technology to preserve the activity of natural collagen. For the materials thus obtained, the significant antimicrobial activity, moderate cytotoxicity and cell-specific responses have been shown in *in vitro* studies with human cells of different origin – keratinocytes, fibroblasts and osteoblasts.

2. Contributions of a scientific-applied nature related to the interaction of cell membranes with amphiphilic molecules of natural (No. B4-4, B4-5) or synthetic origin (No. G7-2, G7-3, G7-4, G7-5, D7-6):

- It has been established that the plant secondary metabolites containing amphiphilic molecules (myconoside, sesquiterpene lactones and phenolic acids) can affect the arrangement of membrane lipids, and thus cell contacts and the associated actin cytoskeleton. It has been shown that *Haberlea rhodopensis* extracts may be a good candidate for use in the complex treatment of pathological dermatological states.

- A special “plugin” has been introduced to the program “Cell Tool” for extracting and processing the lipid order parameter (GP) in cell membranes of live cells *in vitro* labeled with fluorescent probes. The mechanism of action of myconoside on cell membrane lipids of lung carcinoma cells (A549) has been established for the first time, depending on the treatment concentrations used.

- It has been shown on model systems of cancer and non-cancer cells that *in vitro* activity of the synthetic amphiphilic drugs, miltefosine and rifampicin, is significantly increased when applied simultaneously with an electric field. It has also been found that combining the drugs with electroporation for local application enhances their cytotoxicity and allows treatment with lower effective doses. Cancer cells have been shown to be more sensitive than non-cancer cells.

Senior Assist. Prof. Aneliya Kostadinova has provided guidelines for her future research work, which will continue in three main directions: 1) Nanotechnology – the development of new 3D biocompatible nanocomposites with a matrix of RGO (reduced graphene oxide) for biomedicine and tissue engineering; 2) Nanomaterials with optical properties that also have highly pronounced anticancer and antibacterial activity; 3) Fundamental research of structural and functional liquid crystal nanocomposites for applications in photonics, sensors and biomedicine.

Conclusion

The materials presented for the competition and the scientometric indicators of Senior Assist. Prof. Aneliya Kostadinova, PhD, meet all the requirements and cover the minimum required points for all groups of indicators of the ADASRB and the regulations for its implementation at IBPhBME-BAS.

I confidently believe that she is an established scientist, who, with her competence and scientific output, is a very suitable candidate for the academic position “Associate Professor” in the Department “Lipid-Protein Interactions” at IBPhBME-BAS.

All mentioned above allows me to give my positive assessment and strongly recommend to the Scientific Jury to prepare a proposal to the Scientific Council of IBPhBME-BAS for the election of **Senior Assist. Prof. Aneliya S. Kostadinova, PhD, for the academic position “Associate Professor”** in the professional field: 4.3. Biological Sciences and scientific specialty: Biophysics.

Date: 19.09.2022

Prof. Anelia Dobrikova, PhD