

Competition for an Associate professor
4.3. Biological Sciences (biophysics)

Reviewer
Prof. Rossitza Konakchieva, Dr Habil

REVIEW

On a competition for the position "Associate Professor" in a professional direction 4.3. Biological Sciences (Biophysics), for the needs of the Department "Lipid-Protein Interactions", Institute of Biophysics and Biomedical Engineering, BAS, announced in SG, no. 32/26/04/2022

by Prof. Dr.Habil. Rossitza Konakchieva, SU "St. Kliment Ohridski"

Normative basis and eligibility of the applicant

In the competition for the academic position of "associate professor" in 4.3 Biological sciences (biophysics), one candidate appeared - Anelia Stefanova Kostadinova, PhD, chief assistant at IBFBMI-BAS, "Lipid-protein interactions" Department. The presented materials are in accordance with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of ZRASRB, the Regulations on the Terms and Procedures for Acquiring Scientific Degrees and Holding Academic Positions of IBFBMI-BAS. The documentation for the competition is well compiled and comprehensively reflects the research, project and teaching activities of the candidate.

Biographical data

Dr. Anelia Kostadinova graduated in 1993 with a master's degree in Cell Biology and Developmental Biology at the Faculty of Biology of the University of St. Kliment Ohridski". Her career developed entirely at the Institute of Biophysics, later the Institute of Biophysics and Biomedical Engineering of the Bulgarian Academy of Sciences. Over the years, she held the positions of biologist-specialist (1995-2003), assistant (2003-2006) and chief assistant since September 2006. In 2012, she obtained a diploma for PhD in professional direction 4.3. "Biological Sciences", scientific specialty "Biophysics" for a defended dissertation on the topic: "Modulation of interaction of cells with polymer surfaces and membranes", developed at IBFBMI-BAS. The candidate's scientific career was marked by several successful specializations in the period 1996 - 2005 at the GKSS Research Center, Institute of Chemistry, Teltow, Germany, where she conducted research on mechanisms of cell signaling and adhesion, biocompatibility of new materials for application in biomedicine, in vitro cell models. Dr. Kostadinova has experience as a participant in projects (intra-institutional contracts, inter-academic exchange), including as a mentor on the "Student Practices" project of the MES. In the period 1994-2020, she participated in the development of 18 scientific thematic projects, incl. international and extramural collaborations, which gives an understandable reflection in the presented interdisciplinary subject requiring multi-team professional coordination and infrastructure.

Dr. Anelia Kostadinova is a member of the editorial board of scientific publications such as SCIREA Journal of Biology. <http://www.scirea.org/journal/Biology>, Journal of Chemical,

Environmental and Biological Engineering (JCEBE) <http://www.sciencepublishinggroup.com/j/jcebe>, Journal of Bioanalysis & Biomedicine, Open Access, OMICS International, <https://www.omicsonline.org/>

Research profile of the candidate

The research activity of Dr. Anelia Kostadinova fully corresponds to the scientific specialization of the habilitation competition - biophysics, with a focus on membrane physiology and cell behavior, adhesive properties and cell-matrix interactions, membrane lipid-lipid and lipid-protein interactions. The total number of scientific publications of the candidate is 45 with over 125 noticed citations in Scopus and h-index 5.

In regard to research field the following scientific directions of a fundamental-applied nature stand out: 1/ evaluation of the biocompatibility and applicability of new materials of synthetic or natural origin, including nanoparticles for the purposes of theranostics and regenerative medicine by studying morphological characteristics, behavior and adhesive properties of various cell lines when interacting with them in in-vitro models; 2/ in-vitro studies on the mechanisms of interaction of cell membranes and membrane-associated molecules with amphiphilic substances of natural or synthetic origin in order to characterize new formulas with antitumor action; 3/ study of lipid-protein and lipid-lipid interactions in cells by using model membranes and cell models, with a focus on the influence of oxidative processes on the function of membrane lipids and proteins involved in membrane organization and properties.

Scientific contributions

Contributions of a fundamental nature from research on the interaction of human cells with synthetic or natural materials, including nanoparticles, is reflected in publications B4-1, B4-2, G7-1, G7-7, G7-8, G7-9, G7-10, G7-11, G7-12, G8, X1, X2, X4. In studies of the interaction of fibroblasts with synthetic substances with predetermined properties to assess their biocompatibility, a different organization of αV integrin of the adhered cells on hydrophobic materials was shown. Reorganization and disruption of focal adhesive contacts and cell-to-substrate attachment strength, which are critical for the tissue biocompatibility of the studied materials, were found. In collaboration with a team from HTMU, synthetic coatings were created, made of polydimethylsiloxane (PDMS) by plasma treatment, followed by conjugation of acrylic acid with different densities and polyethylene glycol (PEG) with different chain lengths. It was found for the first time that the interaction of cells with modified polyethylene glycol surfaces depends on the length, structure and density of the polymer chains, as well as the presence of COOH groups bound to PDMS. Improved characteristics were also obtained with co-polymer surfaces with polyvinylpyrrolidone – PDMS4k-b-PVP and PDMS10k-b-PVP (G7-1, X5). For the purposes of regenerative medicine in skin diseases, a new synthetic block-co-polymer, homogeneous PDMS-b-PAA (polydimethylsiloxane-block-polyacrylic acid) with different chain lengths has been created in collaboration with teams from the Luxembourg Institute of Science and Technology and HTMU of PAA obtained by electrospinning. The obtained PDMS-b-PAA surfaces were studied in cell models and showed improved characteristics favoring the attachment and proliferation of epithelial cells.

The candidate's research on the biocompatibility of nanoparticles is aimed at creating metal-containing complexes with improved functional characteristics. The incorporation of cis-platinum into composite materials demonstrates a new promising approach for functionalization and avoiding side effects in biomedical applications, including anti-cancer therapy. A significant number of studies in which the candidate class is involved relate to the incorporation of metal compounds into natural polymer structures in order to increase their biocompatibility, which successfully improves the technical properties of biocompatibility. Scientific-applied contributions refer to the development of new materials with significant antimicrobial activity and moderate cytotoxicity in in-vitro cell models with human cells of different origin – keratinocytes, fibroblasts and osteoblasts. It has been established that collagen composite materials with graphene oxide incorporated into them, as well as silver or silicon compounds added to it, show increased antibacterial activity against a wide range of microorganisms and moderate cytotoxicity against human epithelial cells. In summary, these studies represent original scientific contributions of a fundamental and applied nature important to the development of biomedical engineering.

The group of scientific-applied contributions related to the interaction of cell membranes with amphiphilic molecules of natural or synthetic origin are reflected in publications B4-4, B4-5, X3, X8, G7-2, G7-3, G7-4, D7-6, D7-5. The contributions of this group of studies can be summarized as follows: a/ plant secondary metabolites containing amphiphilic molecules (mycoside, sesquiterpene lactones and phenolic acids) can influence the arrangement of membrane lipids, and hence cell contacts and the associated actin cytoskeleton; b/ an original special plug-in was created and successfully used through the application "Cell Tool", developed by the scientific group with the participant Dr. Kostadinova, which allows the estimation of the order parameter of lipids in cell membranes of living cells in a monolayer, labeled in vitro with Dianep and Laurdan fluorescent probes; c/ it was established that the in-vitro activity of the synthetic drugs miltefusin and rimfamycin, containing hydrophilic and hydrophobic regions in their molecule, increases significantly when applied simultaneously with an electric field.

Assessment of compliance with mandatory minimum requirements

In current competition, Dr. Anelia Kostadinova presented a total of 17 scientific publications outside the list of publications for the acquisition of a PhD with a total impact factor of 26.354, and a book in an electronic edition. Attached is a list of articles without IF and those that are not referenced in Scopus or Web of Sci in total 15 in number, as well as participation in 15 national and international scientific forums. This scientific production of the candidate characterizes her as a modern scientist working in a specific and important field for biomedicine and biomedical engineering. According to the presented report, the publications included in the competition were cited a total of 32 times.

In summary, the presented indicators according to ZRASRB and PPZRASRB, by area 4. Natural sciences, mathematics and informatics Professional direction 4.3. Biological Sciences, in sub-categories, are as follows:

1. According to group of indicators "A" - 1. Successfully defended dissertation for the award of ONS "Doctor" - (50 points out of the required 50 points)

2. By group of indicators "B.4" - Habilitation work or scientific publications in publications that are referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus). 5 publications with a total impact factor of 8,568 are presented, of which with rank Q1 – 2 items; Q2 – 2 pcs.; Q3 – 1 pc. (105 items out of required 100 items). In two of them, the candidate is the first author, in one second, which testifies to her active participation and contribution in the development of the problem.

3. According to group of indicators "D" - Scientific publications outside the habilitation work in publications that are referenced and indexed in world-famous databases, 12 publications and one chapter of a book are presented, in seven of which the candidate is the first author. The total impact factor for these publications is 17,766 and they are distributed by quartiles as follows: rank Q1 – 3pc.; Q2 – 2 pcs.; Q3 – 7 pcs. (235 items out of required 220 items)

4. By group of indicators "D" - Citations in scientific publications, monographs, collective volumes and patents, referenced and indexed in world-famous databases with scientific information - 32 citations (64 items out of the required 60 items)

I accept as fulfilled the minimum national requirements under Art. 2b from ZRASRB, as well as those of IBFBMI-BAN for professional direction 4.3 Biological sciences (biophysics).

Teaching activity

Dr. Anelia Kostadinova has a long-standing teaching and teaching activity as a part-time teacher at the Faculty of Biology, SU "St. Kliment Ohridski" - from 2004 to 2022, where he led exercises in cell biology, cytology and cell cultivation, biochemistry (2021-2022), lectures and exercises in cell cultivation in 2014. Under the scientific guidance of Dr. Kostadinova, four diploma theses were successfully defended at the departments of "Cytology" and the Department of "Biochemistry" of the Faculty of Medicine.

In conclusion,

This application is in accordance with the minimum national requirements for holding the academic position of "associate professor", as well as with the specific requirements specified in the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria at the Institute of Biophysics and Biomedical Engineering at the BAS.

In view of what has been stated about the candidate's professional research and teaching activities, I strongly recommend to the Honorable members of the Scientific Jury appointed by order No. 304/30.05.2022 of the Director of IBFBMI-BAS to propose to the Scientific Council, Dr. ANELIA STEFANOVA KOSTADINOVA to be elected to the academic position of "associate professor" in the Professional field 4.3. Biological Sciences (Biophysics) for the needs of the "Lipid-Protein Interactions" Section, Institute of Biophysics and Biomedical Engineering, BAS.

14.09.2022

Signature:

/Prof. Rossitza Konakchieva, Dr Habil/