

REVIEW

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by Prof. Tania Koleva Pencheva, PhD

Institute of Biophysics and Biomedical Engineering – Bulgarian Academy of Sciences

For the concourse for promotion to the academic position “Professor”,
announced in **State Gazette**, issue 54 of 12.06.2026

Area of Higher Education: **4. Natural Sciences, Mathematics, and Informatics**

Professional Field: **4.6. Informatics and Computer Sciences**

Scientific Specialty: **Informatics (Informatics Tools in Biomedicine)**

Candidate: **Assoc. Prof. Lyudmila Pavlova Todorova, PhD**

Review of the presented materials

With Ordinance No. 695/15.07.2026 of the Director of the Institute of Biophysics and Biomedical Engineering (IBPhBME) – Bulgarian Academy of Sciences, I have been appointed as a member of the Scientific Jury in a **concourse for the academic position “Professor”** where the only candidate is **Assoc. Prof. Lyudmila Pavlova Todorova, PhD**.

As a member of the Scientific Jury, I have received:

1. Documents regarding the candidate's participation in the concourse.
2. Copies of the publications submitted for participation in the concourse.

In the presented form, the documents of **Assoc. Prof. Lyudmila Todorova, PhD** meet the requirements stipulated in the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB), as well as the regulations for its implementation, approved by the Council of Ministers and the IBPhBME – BAS.

Short biographical notes

Lyudmila Todorova graduated with a M.Sc. degree in Engineering, specializing in “Automation and Telemechanics” from the Technical University of Sofia in 1984. She began her scientific career in 1996 as a Research Fellow (Grade III) at the Central Laboratory of Biomedical Engineering “Prof. Ivan Daskalov” (CLBME) – Bulgarian Academy of Sciences (BAS), where in 2006, as a PhD student through independent study, she defended her PhD degree in the field of “Application of the Principles and Methods of Cybernetics in Different Fields of Science”, with a thesis titled “System for Analysing the Condition of Patients Undergoing Weaning from Prolonged Mechanical Ventilation”. Since 2011, Lyudmila Todorova has held the academic position of Associate Professor within the Bioinformatics and Mathematical Modelling Department at the IBPhBME – BAS. Her research activities span the fields of informatics, statistics, and biomedicine.

Publication and lecturing activities, project participation

For participation in the concourse for promotion to the academic position “Professor”, Lyudmila Todorova has presented **34 scientific publications**, of which **33 in journals that are refereed and indexed in world-renowned databases of scientific information** and **1 book chapter**. **Sixteen of her publications in refereed and indexed journals are with an impact factor and 11 – with an impact rank.**

Upon reviewing the documents submitted by Lyudmila Todorova, I would like to draw attention to the following: 1) In “07_Detailed Report on Materials Provided by Lyudmila Todorova”, under “Results Achieved by the Candidate”, it is stated that there are “15 publications in journals with an impact factor (IF); h-index = 11 (SCOPUS, excluding self-citations)”, whereas the correct numbers are 16 articles in

journals with an IF and an h-index of 6 (SCOPUS, excluding self-citations) — a fact confirmed by an independent check; 2) The numbering of Lyudmila Todorova's publications submitted for the concourse is inconsistent across the various documents; i.e., in "*08_List of Publications for the Position of Professor*" they are numbered 1 through 34, while in "*12_Extended Habilitation Report*" they are initially cited as "[B2, B8, B9, B10, B12, G1, G2, G3, G4, G5, G6, G7, G8, G9, G19, G21]" and subsequently as "[B4_1, B4_9, G7_12, G7_16, G7_17]"; 3) In "*12_Extended Habilitation Report*", a book chapter is listed as G22, whereas according to "*07_Detailed Report...*" it is numbered G34; 4) In "*07_Detailed Report...*" for the publication G22 a "SJR 0." value is assigned. Following a check in *SCImago*, the journal "General Medicine" is found to have a SJR value of 0.101 for 2017; 5) Publication G29 appears with different bibliographic descriptions in "*07_Detailed Reference...*" and "*08_List of Publications for Professor*"; I consider the description in "*07_Detailed Reference...*" to be the more accurate one. All the aforementioned inaccuracies are of **technical nature** and **do not affect** the total number of points under the respective **Groups of indicators**.

All scientific publications presented for participation in the concourse are co-authored, but I would still like to note the fact that in **7** of the collective works, **Lyudmila Todorova is the first author and in 14 of the articles in which she is the second author, her contribution is equal to that of the first author**. This fact irrefutably shows the **personal input of the candidate** in her research developments. I recognize all publications by Lyudmila Todorova presented for the concourse as fully compliant with the requirements for proven excellence of the scientific publications, as well as strictly relevant to the thematic scope of the concourse.

In "*07_Detailed Report...*" and "*12_Extended Habilitation Report*" Lyudmila Todorova indicates a total of 520 citations in refereed and indexed sources for the articles submitted for the concourse (out of 598 total citations), including 208 in Scopus, thereby accumulating **2184 points**, which far exceeds the **minimum requirement of 120 points under Group of Indicators D**.

Lyudmila Todorova has provided a list of her participation in **9 projects**, including **2 projects** under the Operational Programme "Innovation and Competitiveness", **4 projects** funded by the Bulgarian National Science Fund (one of which she coordinated), and **3 bilateral cooperation agreements**. I would like to draw attention to the fact that, in the document "*07_Detailed Report...*", the projects under the Operational Programme "Innovation and Competitiveness" are classified as international; however, they are, in essence, national projects funded by European Structural Funds. Consequently, Lyudmila Todorova's participation in these projects should be awarded 10 points each, rather than 20. This results in a reduction of 40 points under **indicator E15** (from 100 to 60) and an increase of 20 points under **indicator E14** (from 40 to 60). As a result, the total score under the **Group of indicators E** changes from 190 to 170—a figure that **nonetheless remains significantly above the required minimum of 100 points**.

Based on the above, it can be stated with confidence that the candidate, Lyudmila Todorova, meets both the minimum national requirements and the specific requirements of the IBPhBME – BAS for the academic position of "Professor".

Analysis of the main fundamental and applied research contributions

The scientific works presented by Lyudmila Todorova are aimed at expanding the theoretical frameworks of the core scientific areas within her research activity—namely, intuitionistic fuzzy sets (IFS), indexed matrices (IM), intercriteria analysis (ICA), and generalized nets (GN)—as well as their application across various fields of biomedicine. In the document "*12_Extended Habilitation Report*", Lyudmila Todorova outlines **3 scientific contributions and 4 contributions of scientific-applied nature**, derived from in-depth investigations into current fundamental and applied scientific challenges. **I fully accept the contributions as presented by the candidate**; however, I would like to summarize them according to the specific scientific areas of her research activity:

- 1) In the field of IFS, Lyudmila Todorova has contributed to expanding their theoretical foundations by introducing a new ordering relation, a new type of relation, and new operators

- for geometric interpretation, as well as a scheme for deriving a graded intuitionistic fuzzy assessment of the information contained in Kaplan-Meier curves.
- 2) In the field of IM, Lyudmila Todorova has contributed to the development of new approaches for IM aggregation based on the concept of "full relevance". These approaches facilitate improved knowledge discovery and the selection of the most informative input data.
 - 3) The contributions listed above are also directly relevant to the development of the theoretical framework of ICA, which is built upon the mathematical formalisms of IFS and IM. Furthermore, specifically regarding ICA, Lyudmila Todorova has made contributions to:
 - Development of the theoretical foundations of ICA through the introduction of new algorithms for calculating degrees of similarity between criteria and the new modifications of the ICA.
 - Demonstration of the reliability of the proposed algorithms and modifications through their successful application to real-world data in the fields of neurosurgery and urology, with the results compared against those obtained using classical statistical methods.
 - Identification of interrelations (consonance and dissonance) between criteria, and the subsequent use of these findings to support medical decision-making in diagnosis, treatment, prevention, and rehabilitation in the fields of neurology, ophthalmology, intensive care (resuscitation), and neurosurgery.
 - 4) Beyond the contributions listed above, which can be considered as addressing the theoretical foundations and applications of specific informatics approaches, I would also distinguish Lyudmila Todorova's research focused on developing comprehensive algorithmic and practical solutions in biomedicine as an exceptionally valuable part of her scientific output, namely:
 - The creation of indices for use in clinical practice in the fields of neurology and neurosurgery.
 - The development of the commercial computer system *Rila CogniSoft*, designed for the assessment and rehabilitation of neuropsychological impairments in patients with multiple sclerosis. A new methodology for diagnosis and rehabilitation was created, piloted, tested, and validated. Two novel approaches for evaluating neuropsychological outcomes were introduced, enabling the early detection of cognitive impairments in patients with multiple sclerosis.
 - The formal description, using the apparatus of GN, of algorithms required for the development of medical software products, specifically for:
 - ✓ supporting clinical decision-making regarding the readiness of critically ill ventilator-dependent patients to be weaned off mechanical ventilation;
 - ✓ determining the progression of multiple sclerosis based on the neurophysiological assessment of multimodal evoked potentials;
 - ✓ the recording, assessment, and rehabilitation of cognitive impairments in patients with multiple sclerosis.

I consider the so formulated contributions of Lyudmila Todorova as original and reflecting her overall scientific research activity. I am convinced in my opinion that her **contributions are of essential importance** for the development of the field of current biomedicine. **The high number of citations** of the research works of Lyudmila Todorova is yet **another independent testimony** for the quality of the excellent research results achieved with her active participation.

Personal impressions

I have known Lyudmila Todorova personally since almost the beginning of her scientific career, in my capacity as Scientific Secretary—first at the CLBME – BAS, and subsequently – at the IBPhBME – BAS. My personal impressions of her are of a **responsible, conscientious, hard-working, and diligent colleague.**

Лични впечатления

Познавам лично Людмила Тодорова почти от началото на нейната научна кариера, в качеството ми на научен секретар първо на ЦЛБМИ „Проф. Иван Даскалов“ – БАН, а впоследствие – и на ИБФБМИ – БАН. Моите лични впечатления за нея са за **отговорен, съвестен, трудолюбив и работоспособен колега**. Всички тези лични качества намират своето отражение в материалите, представени от Людмила Тодорова в настоящия конкурс за академичната длъжност „професор“.

Заклучение

За формиране на крайната оценка на кандидата **доц. д-р Людмила Тодорова** за заемане на академичната длъжност „професор“ следва да бъдат отчетени изискванията на ЗРАСРБ и на Правилниците на Министерски съвет и на специфичните изисквания на ИБФБМИ – БАН за неговото прилагане. Съгласно представените документи по конкурса и техния анализ, **доц. д-р Людмила Тодорова покрива и дори надхвърля изискванията за заемане на академичната длъжност „професор“**.

Въз основа на представените документи по конкурса и публикациите, които дават публичност на получените резултати, както и на значимостта на съдържащите се в тях приноси, си позволявам да препоръчам на уважаемите членове на Научното жури да предложат на уважаемите членове на Научния съвет на ИБФБМИ – БАН да гласуват **доц. д-р Людмила Павлова Тодорова** да заеме академичната длъжност „професор“ по професионално направление **4.6. Информатика и компютърни науки**, научна специалност **Информатика (Информатични средства в биомедицината)**.

15.10.2026 г.

София

Подпис:.....

(проф. д-р Таня Пенчева)