REVIEW

by Prof. Iva Ugrinova, PhD - Institute of Molecular Biology, BAS

Regarding: competition for Associate Professor, announced in State Gazette No. 24/21.03.2025. The scientific committee was appointed by Order 64-OB/31.03.2025 of the Director of the Institute of Molecular Biology "Acad. Roumen Tsanev" at BAS (IMB-BAS).

General Section:

This review is prepared following the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), its implementing regulations, and the Rules for acquiring academic positions at IMB-BAS. The only applicant in this competition is Chief Assistant Prof. Dr. Kiril Todorov Kirilov from the "Gene Activity Regulation" section at IMB-BAS. A review of the documents confirms that the procedure for announcing the competition was followed according to LDASRB requirements. The detailed report for fulfilling the minimum requirements under indicator B includes three publications in Q1 journals (3x25 pts), one in a Q3 journal (1x15 pts), and one with SJR but without IF (1x10 pts), thus meeting the required 100 points. Under indicator G, seven publications, three book chapters, and two patents were submitted, covering the required 220 points. Indicator D includes 30 citations, meeting the required 60 points.

Biographical Overview:

In 2001, Kiril Kirilov earned his Master's degree in Biotechnology from the University of Chemical Technology and Metallurgy – Sofia (UCTM-Sofia), and in 2014, he successfully defended his PhD in Molecular Biology (4.3. Biological Sciences) at the Institute of Molecular Biology "Acad. Roumen Tsanev." Eng. Kirilov began work in the "Gene Activity Regulation" section in 2007 under the supervision of Acad. Ivan Ivanov. In 2009, he became a Research Associate III, and in 2011, he won the competition for Chief Assistant in the same section, where he continues to work.

Scientometric Indicators:

The candidate submits 12 publications, three book chapters, and two patents. His work presents original scientific results published in reputable international journals with impact factor or SJR. For indicator group B, Kirilov presents six publications – three in Q1 journals (IF 17.672 total), one in Q3 (IF 1.762), and one with SJR but no IF. For group G, seven publications are included – one Q1, two Q2, and four Q3, totaling IF 15.4. Also notable are two patents registered with the Bulgarian Patent Office. These achievements fulfill IMB-BAS's minimum requirements for the Associate Professor position.

Evaluation of Scientific Contributions:

The candidate's main results reflect multidisciplinary research with originality and innovation. His contributions are evident in key areas: **computer-aided drug discovery (CADD), genome and translational regulation, enzymatic deglycation and molecular homeostasis, bioinformatics tool development, and STEM education.**

1. Computer-aided drug discovery and therapeutic design

In publications (B1, B2, B4, G7.2, G7.7), the candidate shows strong expertise in applying in silico techniques such as molecular docking, virtual screening, ADME-Tox prediction, and DFT calculations to identify and optimize drug candidates. These were applied to diseases like Alzheimer's, Parkinson's, and COVID-19. His hybrid molecules show promising AChE inhibition, antioxidant effects, and drug repositioning potential. **The search for new drug candidates through in silico approaches and their validation through in vitro and in vivo methods is a compelling example of modern translational science.**

2. Genomics, Codon Usage and Translational Regulation

Publication G8.3 presents a detailed review of codon context and frequency in prokaryotic and mitochondrial genomes. The candidate addresses the fundamental relationship between codon usage and gene expression levels, based on the analysis of 158 prokaryotic genomes encompassing a broad taxonomic range. His approach combines bioinformatics, genomics, and experimental validation, significantly contributing to our understanding of gene regulation mechanisms. **The complex approach, combining bioinformatics, genomics, and**

experimental validation, contributes significantly to the understanding of the molecular mechanisms of gene regulation and the relationship between codon structure and gene expression, laying the foundation for precise bioengineering applications.

3. Functional Biochemistry of Glycation and New Enzymatic Activities

Through publications (G7.1, G7.5, G7.6, G8.1, G8.2), the candidate investigates glycation processes in depth, revealing a new function for phosphoglucose isomerase (Pgi) as a deglycase. In vivo significance is confirmed, and a mechanistic model is proposed. Additional studies include purine anti-glycation effects, nuclease activity of allenic acids, and the role of L-lysine in aging. **The identification of a novel enzymatic function in a widely distributed enzyme such as Pgi represents a major breakthrough with potential implications for anti-aging and metabolic research.**

4. Genetic Engineering and Stability of Expression Systems

Publication G7.3 examines the effects of 3'-truncations of the hIFNγ gene on plasmid stability in E. coli. Mathematical modeling and empirical testing reveal a strong link between mRNA levels and plasmid instability, providing valuable data for biotechnology applications. **The study provides actionable data for the design of more stable expression systems in biotechnological processes.**

5. Software Tools for Automated Analysis

Publication B.3 describes a novel Java-based application, 'DNA size finder', for automated image analysis in DNA fiber assays. The tool enables fast, reproducible, and objective processing of microscopy data, reducing manual subjectivity. **An effective tool for highly precise and reproducible analysis is provided, removing the subjective factor in interpretation.**

6. Integrated Systems for Diagnostics and Precision Medicine

A conceptual in silico model for breast cancer diagnostics and therapy integration is presented. **The system combines imaging, molecular biology, and AI analysis, showcasing a forward-looking approach to digital oncology and**

personalized medicine. The study reveals a visionary approach to digital oncology and personalized medicine by unifying multimodal data.

7. Contribution to Science Education

In patents G7.9.1 and G7.9.2, the candidate developed a teaching kit for chemistry and environmental protection. The set supports STEM education at primary and secondary levels by offering accessible and engaging tools for practical learning. **Supports STEM education by creating innovative, applicable, and accessible educational resources.**

Evaluation of Additional Indicators:

Projects and Funding

Dr. Kiril Kirilov has participated in five national research projects funded by the Bulgarian National Science Fund and the Ministry of Education. His involvement reflects strong project engagement and contribution to IMB's research capacity.

Teaching and Educational Activities

Between 2014 and 2021, Dr. Kirilov taught bioinformatics courses (lectures and practicals) at four faculties of the Technical University – Sofia. From 2022 to 2024, he lectured on bacterial genetics and at least six other subjects at New Bulgarian University.

Recommendations to the Candidate:

Given the multidisciplinary nature of his research, the number of first-author publications is understandably modest. Still, I encourage Dr. Kirilov to develop the bioinformatics field at IMB further and aim for lead authorship in high-impact publications.

Conclusion:

Dr. Kirilov's scientific output is extensive, conceptually rich, and methodologically diverse. His research spans fundamental and applied studies in bioinformatics, pharmacology, molecular biology, and biochemistry. Notably, he creates tools and models of both theoretical and practical value. Based on my direct impressions from our collaboration, I attest to his professionalism, collegiality, and

mentorship abilities. I strongly recommend that the Scientific Committee and the IMB Scientific Council vote positively for his appointment as Associate Professor at IMB-BAS.

Date: 08.08.2025 Prof. Dr. Iva Ugrinova

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