SCIENTIFIC OPINION

from **Prof. Maria Bogomilova Angelova, DSc**, The Stephan Angeloff Institute of Microbiology, Bulgarian Academy of Sciences Regarding: Competition for the Academic Position of "ASSOCIATE PROFESSOR", Professional Field 4.3 Biological Sciences, Scientific specialty Genetics for the needs of the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences (IBER-BAS), presented to a scientific jury, formed by order No. 18/28.02.2025 of the Director of IBER-BAS

In the competition for "Associate Professor", announced in the State Gazette, issue 110/31.12.2024, documents have been submitted by Dr. Petya Nikolaeva Parvanova, Chief Assistant Professor in the "Environmental Mutagenesis" section at the "Ecosystem Research, Ecological Risk and Conservation Biology" at IBER-BAS.

1. GENERAL OVERVIEW OF THE PROCEDURE AND THE CANDIDATE

To participate in the competition, Dr. Petya Parvanova has submitted the necessary documents and materials proving the fulfillment of the requirements for occupying the academic position of "Associate Professor" on an electronic medium. All of them are in accordance with the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its implementation, as well as the Regulations of the IBER-BAS. The documents are well-written and comprehensively reflect the candidate's research, teaching, and project activities.

Dr. Petya Parvanova obtained her Bachelor's degree in Ecology from Southwestern University "Neofit Rilski" in Blagoevgrad in 2003 and her Master's degree in the same specialty from Sofia University "Kliment Ohridski" in 2005. In 2011, she was awarded the educational and scientific degree "doctor" from IBER-BAS. Her scientific career started in 2010 as an assistant in the section "Environmental Mutagenesis" at the Department of "Ecosystem Research, Ecological Risk and Conservation Biology" in the IBER. She has been employed as a Senior Assistant since 2011. The candidate has accumulated more than 15 years of professional experience.

Dr. Parvanova has a strong administrative background. For 4 years (from 2015 to 2019) she has been the Head of the Section "Environmental Mutagenesis" and at the same time the Young Scientists' Representative in the SC of the Institute. The candidate has been very actively involved in organizing the International Workshop on Ecology as Secretary of the Organizing Committee for 11 years. She is a member of the Union of Scientists in Bulgaria, Biology Section, of which she is the Secretary.

The research and teaching activities of the candidate are entirely related to the subject of the competition and reflect current and promising areas of Genetics.

2. CHARACTERISTICS OF THE CANDIDATE'S ACTIVITY

Assistant Professor Petya Parvanova is co-author of 48 scientific works, including 46 scientific articles and 2 book chapters. She submitted 21 scientific articles and 2 book chapters for the competition. Of these, 11 were published in journals with IF, and the total IF was 11.449 with an h index of 5 (Scopus).

Compliance with the requirements of the LDASRB

Reference for minimum requirements:

- Indicator A successfully defended dissertation for the PhD degree 50 pts.
- Indicator C 8 scientific articles (5 with IF and 3 with SJR) 110 pts.
- Indicator D 13 scientific articles (6 with IF and 7 with SJR) and 2 chapters from books - 225 pts.
- > Indicator E 52 citations (Scopus) = 104 pts.
- Indicator F total (not required for Associate Professor)
 - ✓ Participation in 25 scientific and educational projects
 - ✓ Co-author of 3 teaching aids
 - ✓ Supervisor of 1 successfully defended graduate
 - ✓ Scientific Consultant of a PhD thesis

Compliance with additional IBER requirements

The applicant has co-authored 48 articles (20 required); 11 of these are with IF (10 required). The total number of citations is 80 instead of the required 20, and 52 are in journals with IF against the required 10.

The report on the fulfillment of the minimum requirements for the academic position of Associate Professor shows that the candidate scored 489 points, which meets and exceeds the required 400 points. In addition, Dr Parvanova also exceeds the additional requirements of IBER-BAS.

3. EVALUATION OF THE CANDIDATE'S RESEARCH ACTIVITY

The scientific works of Dr. Petya Parvanova fully cover the topic of this competition. They reflect the activity of the candidate in a very topical aspect of modern genetics - the mechanisms/systems involved in overcoming induced stress and genotypic resistance. Four research areas emerge in which important scientific and applied contributions are formulated.

3.1. Prevention of induced mutagenesis (antimutagenesis) by exogenous application of natural products

The results corresponding to this direction are included in 4 journal articles (B4.1; B4.2; D7.6; D7.8) and 1 book chapter (D8.2). The phenomenon of 'induced mutagenesis' is an inevitable consequence of the effects of oxidative stress, resulting in permanent changes in DNA and even heritable changes in the characteristics of living systems. Antimutagenic agents are able to counteract the effects of mutagenic factors. In this aspect, antimutagenesis is a modern and very promising field in genetics. The identification of antimutagenic compounds is among the most promising research directions in recent years. It is in this scientific niche that Dr. Parvanova is looking for new natural products and investigating their mechanism of action. The object of study are extracts of *Clinopodium vulgare* L., *Amorpha fruticosa, Ailanthus altissima*, as well as two of

the main constituents of the extract of *Lilium candidum* - kaempferol and jatropham. Two suitable test systems were selected, namely unicellular green algae of the species *Chlamydomonas* reinhardtii and yeasts of the species *Saccharomyces cerevisiae*.

In my opinion, the more important contributions in this section concern the following:

1. New evidence has been obtained for the protective effect of plant secondary metabolites against oxidative stress-induced DNA damage. The antimutagenic effect was shown to be due to their strong antioxidant potential. The relationship between the mode of exogenous application of natural bioactive substances, the experimental design, and the nature of the final biological effect was established.

2. The biological action of the natural products kaempferol and jatropham was demonstrated for the first time. New evidence was obtained for the role of zeocin in the repair mechanisms of oxidative stress-damaged DNA.

3. Extracts of *Amorpha fruticosa* and *Ailanthus altissima* were found for the first time to have no genotoxic, mutagenic, and carcinogenic capacity to affect a *Saccharomyces cerevisiae* model system. A hypothesis is proposed for their mechanism of action based on the activation of protective enzymes by the HR repair system.

3.2. Assessment of the genotoxic potential of environmental xenobiotics using a suite of in vivo tests and criteria with different resolution options: microbiological, biochemical, and molecular

Assessment of the genotoxic (mutagenic) potential of environmental contamination is attracting increasing attention within environmental monitoring, human health, and basic toxicology. One factor that explains the importance of this field is the relationship between mutagenesis and carcinogenesis. A number of techniques are used to study genotoxicity both *in vivo* and *in vitro*, including the micronucleus assay and its variations, sister chromatid analysis, the "comet assay" and other biomarkers for risk assessment. In this context, the candidate submitted 9 scientific articles and 1 book chapter (B4.3 B4.5; B4.6; B4.7; B4.8; D7.4; D7.11; D7.13; D8.1). A protocol for the assessment of genotoxic, mutagenic, carcinogenic, and DNA-damaging effects of physical and chemical environmental factors, including natural products of plant origin, has been developed based on a suite of test systems with different resolution capabilities (*Chlamydomonas reinhardtii*, higher plants, *Saccharomyces cerevisiae*, and *Myzus persicae*) and a range of chemical, microbiological, biochemical and molecular markers.

The contributions made can be formulated as follows:

1. Genotoxic and DNA-damaging effect of *Narcissus* cv. Hawera extract was established for the first time. A dose-dependent increase in the level of DNA double-strand breaks was demonstrated. The data obtained are a good basis for further studies on different test systems for green technology purposes.

2. Evidence has been obtained on the genotoxic and DNA-damaging effect of essential oil of *Origanum vulgare* subsp. Hirtum and the prospect of its use as a herbicide.

3. Evidence with application in genotoxicology was obtained.

> The importance of lipid peroxidation as a reliable biomarker for assessing the level of induced oxidative stress in plant test systems was confirmed.

 \succ A wide range of biological activities of the preparation of chlorpyrifos have been established, which determine its characterization as a broad-spectrum pesticide.

> Genotypic differences in the sensitivity of unicellular green algae and yeast test systems to demonstrate low concentrations of PbCl₂ damaging DNA and photosynthetic pigments by realizing oxidative stress were characterized.

3.3. Mechanisms of genotypic resistance

The accumulation of residues of pharmaceuticals, xenobiotics, pesticides, etc. in the environment is a serious threat to human health and agricultural production. They cause a range of toxic effects even at very low concentrations. Because of their action, oxidative stress is generated, leading to damage in all intracellular molecules - lipids, proteins, and DNA. The development of systems to predict toxicological effects, and the elucidation of the mechanisms responsible for them, are current problems in genetics of great scientific and practical importance. This section includes 9 papers (Q4.4; Q4.5; D7.1; D7.4; D7.6; D7.9; D7.10; D7.12; D7.13) that outline the following contributions:

1. The first experimental evidence of a specific genotypic response of *S. cerevisiae* against bee venom has been obtained. Increased generation of free oxy-radicals and DNA double-strand breaks were found. A mechanism of action based on direct membrane damage (cytotoxic effect) and indirect DNA damage (genotoxic effect) has been demonstrated.

2. Reliable features in plant cells have been identified for screening genotypes according to their sensitivity to drought-induced oxidative stress.

3. The significance of the physiological state, mitotic cycle phases, and repair potential of cells for the type and extent of cellular response against stress induced by chemical inducers of different natures has been established using modern microbiological, biochemical, and molecular methods.

4. The extent of induced oxidative stress has been shown to depend on the genotype of *Phaseolus vulgaris* L. Proline level is a reliable stress biomarker even in closely related genotypes. The stress protein HSP70 is an early signal of oxidative stress and plant adaptation.

3.4. Assessment of the effect of anthropogenic pollutants and environmental factors using a vascular plant test system concerning ecotoxicology and agriculture

Along with expanding urbanization and industrialization, environmental pollution is increasing rapidly and becoming an increasingly serious threat to living organisms in all ecosystems. The presence of heavy metals in soil and water is one of the most critical environmental problems that reduce crop productivity and directly or indirectly threaten the survival of all species. Absorbed by plants, they accumulate in agricultural products and cause mutagenic reactions leading to cancer. Studies on the effects of various anthropogenic pollutants on ecotoxicology are very topical and of high priority for human health. Included in this section are developments on the response of several higher plant test systems against induced abiotic stress (D7.2; D7.3; D7.5; D7.7).

The contributions made can be formulated as follows:

1. Increased activity of the antioxidant enzymes SOD and CAT has been found to be a suitable indicator for assessing the effect of atmospheric pollutants.

2. Confirmatory data were obtained for the induction of oxidative stress in plants by heavy metal ions and the pesticide paraquat. Their presence in wastewater used for irrigation has been shown to pose a risk in the aspect of ecotoxicology and phytoremediation.

3. The content of pigments with antioxidant activity was found to be responsible for the high degree of adaptability to low temperatures of four *Lactuca sativa* L. The information obtained is useful for agricultural practice.

Here should be added and emphasized the activity of Dr. Parvanova as a reviewer of scientific articles for specialized journals and collections of scientific forums.

I positively evaluate the scientific research activity of Dr. Petya Parvanova in terms of topics, methodological approaches, and achievements. I would like to emphasize that the research is complex, involving specialists with different qualifications, as required by the science of today. The contribution of the candidate is well outlined. Furthermore, all the scientific works submitted for the competition are relevant to the competition's subject matter.

I consider the contributions of the candidate Petya Parvanova to be significant, both of an original scientific nature and of an applied significance. There are achievements of obvious theoretical and methodological character, including obtaining new information and confirming known data in current areas of genetics. Undoubtedly, the achieved results provide a solid scientific basis for future research.

4. TEACHING ACTIVITY

Dr. Parvanova presents documents related to her teaching activity. She has been a visiting lecturer in Biochemistry (lectures and tutorials) at the University of Forestry from 2009 to 2015. She has taught classes in Ecology and Environmental Protection at the Faculty of Biology of Sofia University "St. Kliment Ohridski" a bachelor's Degree in the specialties of Molecular Biology, Biotechnology, Biology and Chemistry, Geography and Biology and Biology and English.

Dr. Parvanova is involved in the training of young staff. She was a supervisor of a graduate student in the Master's program of the Department of Genetics at the Sofia University 'Kliment Ohridski' and a scientific advisor of a full-time PhD student at IBER-BAS. The topics of the developed theses are in accordance with the announced competition.

Based on the above, I evaluate the candidate's teaching and learning activities as an important part of her scientific career and I believe that they include relevant areas in the field of the announced competition.

5. CRITICAL REMARKS AND RECOMMENDATIONS

I have no critical comments on the materials presented. Given Dr. Parvanova's qualifications in current research areas and her skills as a researcher and teacher, I recommend that she be more actively involved in project development as a supervisor.

6. PERSONAL COMMENTS

I have read the materials submitted for the competition in great detail and find Dr. Parvanova to be a qualified scientist in the field of genetics. The subject matter of her publications is contemporary and very topical, centered on important issues of the 21st century. Her participation in collective works characterizes her as a researcher with good teamwork skills.

7. CONCLUSION

The documents and materials, presented by Asst. Dr. Petya Nikolaeva Parvanova complies with the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the LDASRB, and the relevant Regulations of IBER-BAS. The candidate has a sufficient number of scientific works for the competition, published after the materials used in the defence of the PhD. The results achieved in research and teaching activities fully comply with the minimum national requirements and the additional requirements of IBER-BAS, adopted in connection with the application of the LDASRB.

The presented scientific works define Dr. Petya Parvanova as a professionally competent specialist. They have been published in reputable journals and have become known to our and international scientific community. The formulated scientific and applied contributions are the basis for further developments. She is a sought-after partner in the development of scientific projects and an active member of the teams she works with.

After reading the materials and scientific works submitted in the competition, after the analysis of their significance and scientific and applied contributions contained in them, I give my positive assessment and confidently recommend to the Scientific Jury to prepare a report-proposal to the Scientific Council of the Institute of Biodiversity and Ecosystem Research at BAS for the election of the Assistant Professor Dr. **PETYA NIKOLAEVA PARVANOVA** to the academic position of **ASSOCIATE PROFESSOR** at IBER-BAS in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, professional field 4.3. Biological sciences, Scientific specialty Genetics.

April 24, 2025 Sofia

Signature:/Prof. Maria Angelova, DSc/