

In a competition for the academic position "Professor"

**In the field of higher education 4. Natural sciences, mathematics and informatics,
professional field: 4.3. Biological sciences and scientific specialty "Biophysics",**

announced in SN no. 108/22. 12. 2020

**One candidate submitted documents for participation in the competition - Associate
Professor Dr. Anelia Georgieva Dobrikova, Department "Photoexcitable Membranes" at
the Institute of Biophysics and Biomedical Engineering, Bulgarian Academy of Sciences.**

**Reviewer: Professor Dr. Antoaneta Vidolova Popova at the Institute of Biophysics and
Biomedical Engineering, BAS.**

Associate Professor Dr. Anelia Georgieva Dobrikova was born on June 11, 1968 in Plovdiv. In 1986 Dr. Dobrikova completed her secondary education at the Mathematical High School, Plovdiv. In 1991 she obtained master's degree at the Faculty of Biology of Sofia University "St. Kl. Ohridski" with a specialty in Biotechnology and specialization in Biophysicochemistry and in the same year became an employee of the Institute of Biophysics of the Bulgarian Academy of Sciences as a technician in biotechnology. In 1999 Anelia Dobrikova defended her doctor thesis and received the educational and scientific degree "doctor" in the professional field 4.3. Biological sciences and scientific specialty "Biophysics" at the Institute of Biophysics, BAS. Supervisor of the doctor thesis "Surface electrical properties of thylakoid membrane fragments" was Prof. Dr. Stefka Taneva. In 2010 Dr. Dobrikova habilitated as an Associate Professor at the Institute of Biophysics and Biomedical Engineering, BAS.

In the current competition for the academic degree "Professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional field: 4.3. Biological sciences and scientific specialty "Biophysics" the only candidate Associate Professor Dr. Anelia Dobrikova submitted all documents required by the Rules of Application of the Law for

Development of the Scientific Staff of the Republic of Bulgaria (ZRASRB) of IBFBMI-BAS. The completed reference on the minimum national requirements for the position of "professor" shows that Associate Professor Dobrikova significantly exceeds the required points for every of the individual indicators. According to indicator B Assoc. Prof. Dobrikova presents 140 points which exceeds the required 100 points, according to indicator C Dr. Dobrikova presents 385 points which is higher than the required 220, according to indicator D are presented 380 points, much higher than the required 120, and by indicator E Dr. Dobrikova presents 230 points, more than required 150.

The total number of published scientific articles in which Dr. Dobrikova is a co-author is 50. Dr. Dobrikova participates in the current competition for "Professor" with a total of 25 articles, which are after the habilitation as "Associate Professor". The articles are distributed as follows: 21 are in international scientific journals with IF, with a total IF of 57.36. According to the ranking of scientific journals by quartiles, Dr. Dobrikova's articles are distributed as follows: 14 in Q1 journals, 5 in Q2 journals and 2 in Q3 journals. Three of the articles are chapters in specialized editions, and one of the articles in which Dr. Dobrikova is the only author is in an edition without IF or SJR. The state of art of the scientific problems Dr. Dobrikova is dealing with is illustrated by the number of citations her scientific papers obtained (276 according to SCOPUS after excluding self-citations). The H-index of Dr. Dobrikova according to SCOPUS, after excluding self-citations is 10.

The significant scientific contribution of Dr. Dobrikova in the published articles is illustrated by the fact that she is the first author in 9 publications on the topic of the competition, in 7 she is the second author, in 2 is the last author and in one of the publications she is the only author.

The scientific expertise of Assoc. Prof. Dobrikova is also demonstrated by her election as a guest editor of two specialized issues in *Plants* (MDPI), a member of the editorial board of 2 international journals - *Acta Sci. Agriculture, Int. J. Plant Biol. & Res.*, reviewer of international scientific journals (50) and of doctoral thesis for "doctor" (5). Dr. Dobrikova was the supervisor of a graduate student at Sofia University "St. Kl. Ohridski", Faculty of Biology under the project "Student Internships, research supervisor of the Diploma Thesis under the Master's Program" Erasmus" and consultant of a successfully defended doctor thesis at IBPhBME-BAS.

Associate Professor Dobrikova has participated in a number of research projects, both national – Bulgarian Research Fund (3), in the National Food Science Program, and in

international projects - with India and Slovakia. She has participated in a number of inter-academic projects (EBR) - 3 with the Hungarian Academy of Sciences and 1 with the University of Cairo, Egypt. She has been the leader of a youth project with the Bulgarian Research Fund and the leader of the Bulgarian team in an international (EBR) project with Aristotle University of Thessaloniki, Greece.

The only one candidate in the current competition for the academic position of "Professor", Associate Professor Dobrikova, has systematized the relevance of her research interests and the contributions of her research papers in the attached extended habilitation report. There is also a list of 4 scientific topics in which Associate Professor Dobrikova will continue her research.

The photosynthetic process that takes place in the thylakoid membranes of photosynthetic organisms (algae and higher plants) is the only natural process that provides all the conditions for maintaining life on Earth - energy, food and oxygen. Continuous climate change and the results of human activity have a significant adverse effect on plants and economically important crops. Under conditions of abiotic stress (low and high temperatures, high light intensity, UV radiation, drought, salt stress, pollution with heavy metals and herbicides) a number of changes occur in the structure and organization of the photosynthetic apparatus and in the efficiency of photosynthetic processes. Photosynthetic organisms have developed a number of mechanisms that ensure their acclimatization and resistance to adverse conditions and investigation of these mechanisms is essential for building a proper strategy to create more sustainable and highly productive plant species and crops. These important issues concerning the alterations in the photosynthetic apparatus of photosynthetic organisms as a result of abiotic stress and the processes of acclimatization are in the focus of the research of Associate Professor Dobrikova and makes her investigation especially relevant.

The research of Dr. Dobrikova is focused on three main topics.

- Study of the relationship between the structural organization and functional activity of the components of the photosynthetic apparatus in conditions of various abiotic stress factors - salinity, high light intensity, high temperature, UV-B radiation, treatment with heavy metals and herbicides.

- Unraveling the mechanisms of adaptation and protection of the photosynthetic apparatus in different crops, as well as the effects of different signal molecules (nitric oxide,

24-epibrasinolide, salicylic acid, DELLA proteins) and antioxidant substances to protect against environmental stressors.

- Special attention is paid to the problems of soil contamination with heavy metals and herbicides, clarification of the mechanisms of plants to reduce their toxic effect, as well as the possibility of using various economically important crops for phytoremediation.

The achievements in the published scientific works of Dr. Dobrikova, some of which represent new scientific data, are grouped into 8 sections. The research was conducted mainly in IBPhBME-BAS, as well as in collaboration with some national and international partner organizations in the implementation of the tasks of the projects in which Assoc. Prof. Dobrikova has participated.

The main achievements of the published articles are:

- The protective role of DELLA proteins on the functional activity of the photosynthetic apparatus under Cd and salt stress has been demonstrated for the first time and it has been shown that these proteins participate in plant stress responses and adaptive responses by altering the structural organization of photosynthetic membranes. Some of the protective mechanisms in two wheat varieties have been established, which improve the tolerance of the photosynthetic apparatus to Cd toxicity.

- Proper fertilization has been shown to be applied as one of the tools to manage metal stress (Cd and As) in wheat and to limit the uptake of toxic heavy metals from the soil in contaminated areas. Understanding the mechanisms by which different wheat varieties absorb and accumulate heavy metals is important for identifying varieties with low metal accumulation to ensure a healthy diet.

- For the first time is presented an experimental evidence for changes taking place in the Mn-cluster and the kinetic parameters of oxygen-evolving reactions as a result of the action of several signaling molecules under physiological conditions (24-epibrasinolide, salicylic acid, DELLA proteins, nitric oxide) which is important for the protection of the oxygen-evolving system under conditions of abiotic stress.

- The protective role and mechanisms of action of salicylic acid on the photosynthetic apparatus of rice plants under Cd stress have been established. It is a new scientific evidence that salicylic acid affects the kinetic parameters of oxygen-evolving reactions, protecting the Mn-cluster from damage, as well as stimulating the cyclic electronic transport around PSI.

- 24-epibrasinolide has been shown to induce structural reorganization of pigment-protein complexes of photosynthetic membranes, which is most likely related to its protective function in plants to environmental stressors.

- It has been found that the medical plant sage (*Salvia sclarea L.*) can accumulate high concentrations of Cd and Zn in its tissues, which confirms the potential of this plant for phytoremediation or phytoextraction of soils contaminated with Cd and Zn. There was also a strong increase in phenols and anthocyanins, as well as increased accumulation of iron in the leaves as protective mechanisms against high toxic concentrations of heavy metals. The accumulated amounts of heavy metals were not found in the essential oils of this aromatic plant, which makes sage economically interesting plant for application in perfumery and pharmacy, as well as for phytoremediation of contaminated soils.

- A new scientific finding was presented that a combination of two modern methods of analysis: chlorophyll-fluorescence imaging (CF-IA) and mass spectrometry with inductively coupled plasma and laser ablation (LA-ICP-MS), can be used for observation of the spatial heterogeneity of the PSII centers and the spatial model of high Cd accumulation in the leaves.

- That increased amount of the oligomeric forms of LHCII, decreased anionic lipids and increased amount of MGDG lipid play a significant role in increasing plant resistance to abiotic stress. The influence of the structural modifications of the cyanobacterial light-harvesting complex (phycobilisomes) on the surface electrical properties and the functions of the photosynthetic membranes was also studied for the first time.

- The places of location and the mechanism of action of the NO signaling molecule on the photosynthetic apparatus in chloroplasts have been demonstrated. Nitric oxide can interact directly with various components of the photosynthetic apparatus, affecting the efficiency of electronic transport and the redox state of the Mn-cluster on the donor side of PSII.

- The relationship between herbicide sensitivity and kinetic parameters of oxygen evolution of cyanobacteria, green microalgae and thylakoid membranes from higher plants have been shown and discussed for the first time, which may find future application in the development of biosensors, applying the principles of high-speed polarographic oxygen electrode (Joliot type).

- Quercetin, naringin and ascorbate have been shown to provide effective protection of the oxygen-evolving complex against UV-B-induced damage due not only to their antioxidant

properties but also to induced structural changes in photosynthetic membranes and Mn-cluster modifications.

It is pointed out that the study of the effects of various signals molecules and/or stress factors on the kinetic parameters of oxygen evolving reactions and redox state of the manganese (Mn) cluster, one of the most sensitive complexes to abiotic stress and of a key importance for plant tolerance, is an important personal contribution of Dr. Dobrikova.

Conclusion:

The submitted documents for participation in the present competition for obtaining the academic position "Professor" are a clear evidence that the research of Associate Professor Dr. Dobrikova is up-to-date, conducted at a high scientific level and represents a serious contribution to unraveling a number of important issues related to the adaptation of photosynthetic organisms to various abiotic stressors and the possibility of using plant species for phytoremediation of soils contaminated with heavy metals and herbicides. Associate Professor Dobrikova significantly exceeds the minimum national requirements set out in the Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB) for obtaining the academic position of "Professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional field: 4.3. Biological sciences and scientific specialty "Biophysics".

Based on everything listed above I strongly recommend the members of the scientific jury to award the academic position "Professor" of Biophysics for the needs of the Institute of Biophysics and Biomedical Engineering - BAS to the Associate Professor Dr. Anelia Georgieva Dobrikova.

Signature:

26. 04. 2021

/prof. A. Popova/

Sofia