

REVIEW

in the competition for "Associate Professor"
in the field of higher education: 4. Natural sciences, mathematics and informatics,
professional field 4.3. Biological Sciences (Biophysics)
in BF of Sofia University "St. Kliment Ohridski announced in SG no. 32 on April 16, 2021.

by Prof. Dr. Veneta Mihova Kapchina-Toteva,
appointed a member of the scientific jury,
according to Order № RD 38-264 / 11.06.2021 of the Rector of Sofia University "St. Kl. Ohridski"

I. Professional and career development of the candidate.

Chief Assistant Dr. Margarita Angelova Kouzmanova is the only candidate in the competition for associate professor, announced for the needs of the Department of Biophysics and Radiobiology, BF at Sofia University "St. Kl. Ohridski". She graduated from Sofia University in 1981 with a master's degree in biology and chemistry. She successfully defended his dissertation in 1997 on the topic: "Study of the biological action and evaluation of the radioprotective efficiency of millimeter electromagnetic waves". Since 1987 she has held the following positions in the Department of Biophysics: specialist biologist (1987–1999), senior assistant (1999–2002), chief assistant since 2002 and until now. An important factor for the development of Dr. Margarita Kouzmanova as an established lecturer is the research on the influence of physical factors on biological systems, including human health; stress and adaptation; biophysics of photosynthesis; her teaching activity, including high classroom (299–427 hours) employment for the last 3 years; active participation in research projects; administrative involvement as a member of the commission for organizing and conducting the National Competition in Natural Sciences and Ecology, MES, 2012–2020, of the fire protection group in BF, secretary of the master's program Biophysics until 2016.

II. Teaching experience.

All lectures (95 hours) and laboratory practice (42 hours) developed by Dr. Margarita Kouzmanova are in the field of Biophysics and Radiobiology:

1. Effects of physical factors on biological systems – 30 hours of lectures.
2. Biophysics and radiobiology – 10 hours of lectures for Bachelor's degree, specialty Biology.

3. Biophysics and radiobiology – 10 hours of lectures for Bachelor's degree, specialty Molecular Biology.
4. Basics of radiobiology – 45 hours of lectures for Bachelor's degree, specialty Nuclear Chemistry at Faculty of Chemistry and Pharmacy.
5. Practical classes: 1 laboratory practice of 3 hours – "Dialysis", for laboratory practice in Biophysics; 5 practices of 3 hours for cycle Radiobiology and dosimetry of ionizing radiation; 7 practices of 3 hours for the course on Effects of physical factors; practical lesson "Osmotic pressure. Alterations of the erythrocyte shape and volume when the osmotic pressure changes" for summer practice in Biophysics – 3 hours.
6. She was the supervisor of 6 successfully defended master thesis and 116 courseworks of students majoring in Molecular Biology, the leader of two national projects with the participation of students, which shows her commitment to improving the skills of students; she participated in the organization of three international forums.

III. Research and publishing, citations.

Dr. Margarita Kouzmanova participated in the competition for "Associate Professor" with a total production of 51 scientific publications with a total IF / SJR of 41,773; 56 participations in scientific forums; 351 registered citations in renowned journals with IF / SJR such as: *Plants, Photosynthetica, Journal of Chemical Theory and Computation, Chemical Science, International Journal of Hydrogen Energy, Photosynth Res., Acta Physiologiae Plantarum, Journal of Plant Nutrition*, dissertations. The scientific publications presented in the competition for "Associate Professor" and subject to review are 19 issues, of which: publications in peer-reviewed and indexed journals – 15 issues, with a total IF / SJR – 40,104; publications in books – 4 issues. In the Scopus scientific database 286 citations are noted, and in others – 65. According to the same database the candidate's h-index is 6. In the competition for the academic position "Associate Professor" the distribution by quartiles of referenced and indexed in world-famous databases with scientific information Web of Science or Scopus publications is as follows: Q1 – 8 pcs., Q2 – 3 pcs., Q4 – 1 pc., and edition with SJR without IF – 1 pc. The attached report shows that Chief Assistant Dr. Margarita Angelova Kouzmanova exceeds the minimum national requirements for the academic position of "Associate Professor" (indicator A meets the minimum national requirements – 50, indicator B is 100 with a minimum value of national requirements – 100, indicator D is 219 with a minimum value of 200 and indicator D is 630 with a minimum value of 50, indicator E – 60 points) Total for all indicators: 1059 points (required minimum: 400 points).

IV. Participation in research projects and programs.

The research is supported by participation in 3 international and 4 national research projects, for two of which she is the leader. The activity of Dr. Margarita Kouzmanova in the development and implementation of projects has contributed to her and the students who participate in them, to development and improvement of the teaching and research base of BF.

My conclusion about that part of the analysis of the scientific activity of Dr. Margarita Kouzmanova is that the procedure is followed and the documentation is prepared in accordance with the requirements of Law on the development of the academic staff in the Republic of Bulgaria and the rules for its application for the academic position of "Associate Professor". In the scientific production of the candidate presented for the competition there are no works that go beyond the main nomenclature specialty. She participates in the competition with scientific papers that fully meet the professional direction of the discipline in terms of volume and quality, in accordance with the requirements of the law and the regulations for its application.

V. Contributions.

The research profile of Ch. Assistant Professor Dr. Margarita Kouzmanova is in the scientific field of the competition – Biophysics, and research can be divided into two areas: biological effects of magnetic and electromagnetic fields (EMF) and biophysics of photosynthesis. The quality of scientific research is proven by the publication of the results in prestigious international journals with IF such as *Biochim. Biophys. Acta*; *Plant Physiology and Biochemistry*; *Theor. Exp. Plant Physiol.*; *Coordination Chemistry Reviews*; *Photosynthetica*; *Cells* etc. The contributions in the scientific works (habilitation reference) are presented objectively.

1. Biological effects of magnetic and electromagnetic fields (EMF)

An original contribution is the study of the effects of a constant magnetic field (MF) on human erythrocytes under *in vitro* exposure where

- noticed dependence of the changes in the erythrocyte membrane properties on the donor's blood group, as well as changes in the binding properties of the lectin and the increased time required for its complete binding under the action of a static magnetic field of 5 mT. The rate and extent of binding may be an indicator of changes in the glycoprotein complex [1, 2];

- temperature dependence of the effects of MP on erythrocyte membranes, followed by changes in the electrophoretic mobility (EPM) and in anion transport through the band 3 protein – combined effect associated with lipid-protein interactions and the distribution of membrane surface charges [3].

The biological effects of high-frequency low-intensity electromagnetic fields (EMF) in two bands with different practical applications was studied: at the level of the whole organism (Wistar rats) in order to elucidate the mechanisms of action of millimeter waves (MMW) with frequencies 53.53 GHz (5.6 mm) and 42.19 GHz (7.1 mm) used in medicine to treat a number of diseases [4], and *in vitro* effects on cells of EMF used in communication systems.

- New experimental data have been obtained (with new methods and studied indicators), confirming the modifying effect of MMW on immune reactivity – an increase in the level of histamine and a decrease in the level of ceruloplasmin in the blood have been found [4].

- it has been confirmed that the effects of low-intensity high-frequency EMFs on human erythrocytes depend on both the field parameters, the exposure time and the time elapsed after irradiation; and from the water content of the suspension. The hypothesis of the role of water in the realization of the effects of high frequency EMF on living organisms has been confirmed – on the changes in the degree of hemolysis of human erythrocytes exposed to 900 MHz EMF [5].

- irradiation with GSM900 EMF (2 W output power, pulse field, 20 min) stabilizes the erythrocyte membrane and leads to a decrease in hemolysis [5].

- It has been confirmed that low-intensity EMFs emitted by mobile phones also affect plants by altering the activity of a number of enzymes [7]. The induced changes depend on the time elapsed after cessation of exposure, as well as on experiments with animals and isolated cells.

2. Biophysics of photosynthesis

A significant part of the research in this field is devoted to the study of the fundamental basis of the highly informative biophysical method, based on the analysis of the luminescent and optical characteristics of plant objects. The measurement of prompt and delayed chlorophyll fluorescence (PF and DF), as well as the modulated reflection of 820 nm light (MR), is fast and non-invasive. The analysis of the obtained data is an informative approach to assess the processes in the photosynthetic apparatus (PSA) and the condition of the plants; as well as to study the biophysical mechanisms of stress reactions in higher plants at the level of PSA, and the mechanisms of their adaptation to adverse environmental conditions.

- An original contribution of fundamental importance and significant practical application as a new methodology for both research and applied research to assess the stress responses of plants are the modifications made to the developed by Prof. Strasser JIP-test based on measurements of prompt chlorophyll fluorescence. These modifications increase the information value of the method, and experimentally measured fluorescence drops can be a means for *in vivo* quantification of the redox reactions of Q_A and Q_B during the increase of fluorescence from F_0 to F_M [9].

A formal approach to characterizing plants *in vivo* is the neural network, developed on the data from measurements of PF, DF and MR signals, and capable of recognizing relative water content (RWC) in “unknown” samples with a correlation of about $R^2 \approx 0.98$ between the calculated and gravimetrically determined values of RWC. This method, developed for determination of RWC in detached leaves, can be developed and used to quantify the stress of drought in crop plants *in situ* [8].

- JIP-test is an informative approach, the application of which is extended to assess the influence of various important stressors on photosynthesis:

- Deficiency of micro- and macro-elements [10, 11, 14, 17]: changes in the parameters of chlorophyll fluorescence precede the visible manifestations of the deficiency and allow for timely adequate fertilization of cultivated crops; the principal component analysis of selected parameters of the JIP-test is a possible species-specific approach for identification / prediction of nutritional deficiency.

- moderately high temperatures [18]: with this biophysical approach the stress reactions, tolerance and adaptability of two plane tree ecotypes (Bulgarian and Italian) were analyzed and compared. The age of the leaves had a significant influence on the stress effects when exposed to moderately high temperatures. The applicability of the method for studying the influence of temperature on PSA and the development of adaptive reactions has been confirmed, using two ecotypes of hitherto unexplored tree species – plane.

Original studies on the parasite-host interaction have shown that the effect of the parasite *Cuscuta campestris* on the PSA of the host *Ipomea tricolor* depends on the physiological age of the leaves of the host plant [16] (a dependence analogous to the reactions of the plane tree leaves under the influence of moderately high temperature [18]).

- The galls of *Smicronyx* insects formed on *Cuscuta campestris* are particularly rich in chlorophyll compared to the stem of the parasitic plant. The analysis of the chlorophyll fluorescence of the galls confirms the presence of an actively functioning photosynthetic apparatus, especially in their inner part - in a more detailed study with more informative methods.

- An original result is the comparison of this photosynthesis induced by insect larvae with the photosynthetic activity in the reference plant *Arabidopsis thaliana* [19].

The accumulated theoretical knowledge and experience from own research are summarized in a monograph dedicated to this methodological approach [12]. This book allows a large number of scientists (mostly in Bulgaria and Russia) applying this biophysical research approach to get acquainted with it in more detail and contributes to the popularization and implementation of the biophysical approach for *in vivo* investigation of changes in plants.

CONCLUSION

I know Dr. Margarita Angelova Kouzmanova as a highly qualified and expeditious scientist. Based on the analysis of pedagogical work (classroom employment), active research, volume of scientific production, interpretation of scientific data and contributions, their reflection in the international scientific literature, participation in research projects, presentation of the results of international and national scientific forums, I am convinced that Chief Assistant Dr. Margarita Angelova Kouzmanova fully meets the requirements of Law on the development of the academic staff in the Republic of Bulgaria and the Regulations, as well the recommended criteria for holding academic positions at Sofia University “St. Kliment Ohridski”. All this gives me a reason to positively evaluate her overall activity. I allow myself to propose to the esteemed Scientific Jury to vote positively, and the Faculty Council of the Faculty of Biology at Sofia University “St. Kliment Ohridski” to elect a chief assistant Dr. Margarita Angelova Kouzmanova as an “Associate Professor” in a professional field 4.3. Biological sciences (Biophysics).

July 30, 2021.

Sofia

Reviewer:

(Prof. Dr. Veneta Kapchina-Toteva)