

## OPINION

by Prof. Ivanka Tsakovska, PhD

Institute of Biophysics and Biomedical Engineering – BAS,

Member of the Scientific Jury appointed with Order № 684/04 Sept 2023

of the Director of the Institute of Biophysics and Biomedical Engineering – BAS

Regarding: Dissertation entitled "Biophysical characteristics of platelets and erythrocytes in women with spontaneous abortions. Markers of disruption of the coagulation system"  
Area of Higher Education: 4. Natural sciences, Mathematics and Informatics  
Professional Field 4.3. Biological sciences  
PhD Programme: Biophysics  
Author: Ariana Anuar Langari  
Supervisor: Prof. Svetla Todinova, PhD

Ariana Langari was enrolled as a doctoral student at the Department "Biomacromolecules and Biomolecular Interactions" of the Institute of Biophysics and Biomedical Engineering - BAS (IBPhBME-BAS) and was taken off the list with right to defence in 2023. The scientific council of IBPhBME-BAS has decided positively on the readiness for defence of the dissertation. The set of materials provided by the applicant is in accordance with all legal requirements of the procedure.

The dissertation is focused on a socially significant pathology, with poorly clarified etiology, namely spontaneous abortions. The study aims to perform a comparative biophysical analysis of platelets and erythrocytes isolated from women with early fetal loss compared to relevant control groups. The dissertation identifies the changes in biophysical parameters of erythrocytes and platelets characteristic of this pathology, that are applicable to the implementation of new markers for assessing the pathological condition during pregnancy.

The dissertation follows a classic and reasonable structure with a text well-illustrated with tables and figures. The research tasks are logically formulated in accordance with the dissertation's goal. The literature review, although too detailed, gives a good idea on the state-of-the-art in the scientific area, as well as ensures that the doctoral student has acquired in-depth knowledge in the field.

The research objects and methods are correctly and comprehensively described. The dissertation results logically follow the formulated research tasks. It is evident that in the frame of this doctoral study significant amount of experimental work has been





performed. The performed studies by means of atomic force microscopy (also flow cytometry in platelets' investigations) have revealed specific differences in morphology and nanomechanics of platelets and erythrocytes isolated from patients with spontaneous abortion compared to the two control groups involved in the study. The grouping of women with early pregnancy loss based on specific morphological changes in platelets has been identified that correlates with the gestational age. An investigation was conducted on the carriage of polymorphisms in the genes of thrombophilic factors and an increased carriage was found in three of them. Here, as well as in the other experiments, it would be interesting to see what is the size of the EPL1 group (women with early pregnancy loss that has occurred between the sixth and ninth gestational week), and it would be good to indicate the size of the groups, for example in Table 1 of the "Experimental Results and Discussion" section. The hypothesis is that carriage of platelets mutations causes structural and nanomechanical abnormalities in platelets, leading to their increased activation. A test with hydrogen peroxide treatment has been conducted and a significant contribution of oxidative stress to morphological changes in EPL senescent erythrocytes has been shown. A particular strength of the dissertation are the experiments with differential scanning calorimetry to determine the thermodynamic characteristics of erythrocytes from patients with early fetal loss relative to healthy controls. The results obtained are in accordance with the results of the atomic force microscopy studies and conclude that the structural changes in erythrocytes affect their thermodynamic behavior.

Based on the conducted studies and the presented results, the doctoral student Langari has formulated conclusions and on their basis six contributions to her dissertation work, which logically summarize the most important scientific achievements discussed above.

I accept the obtained dissertation results as such with significant scientific value and with a significant fundamental contribution.

Undoubtedly, such a complex scientific research has many options for refining and directions to deepen the investigations. It would be valuable the doctoral student to share her vision on this topic.

Ariana Langari has achieved good scientific indicators, particularly given the short period of doctoral research. Three scientific articles on the dissertation topic have been published. In two of them she is the first author that indicates her active role in conducting the results. It should be noted that the publications are in scientific journals with a high impact factor above 4.5, Q1/Q2 quartiles. They already have three citations in the scientific literature. These indicators convincingly exceed the requirements of the Regulations on the implementation of the development of academic staff in the republic of Bulgaria act, as well as the relevant rules in IBPhBME-BAS, according to which the applicant must achieve 30 points in the group of criteria  $\Gamma$ , as well as three publications on the dissertation topic, of



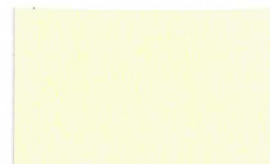
which at least one in an international scientific journal with an impact factor and at least one article where she/he is the first author. It should be noted that the doctoral student Langari collects 70 points in this group of criteria formed by two publications in Q1 journal (50 points in total) and one publication in Q2 journal (20 points). The active role of the doctoral student in dissemination of dissertation results is also an important feature of her work - the results are presented at ten scientific forums through oral presentations and posters. These activities, along with participation in three research projects, have undoubtedly developed a solid foundation for building an active scientific career.

In conclusion, I evaluate the dissertation work of doctoral student Ariana Langari as a valuable research study with important scientific results for biomedical research. The attached author's abstract adequately reflects the content of the dissertation work.

**Due to the above, I give a positive assessment and propose the scientific jury to award the educational and scientific degree "Doctor" to Ariana Anuar Langari in professional field 4.3. Biological Sciences (Doctoral Programme in Biophysics).**

17.11.2023

Member of the Scientific Jury:



(Prof. Ivanka Tsakovska)

