OPINION

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Elected member of a Scientific Jury on the basis of order of the Director of IEMPAM – BAS, Sofia № RD - 09-34 / 28.06.2022

Subject: Competition for academic position "Associate Professor" in scientific direction 4.3. Biological Sciences, Scientific Specialty "Anthropology" (01.06.01), for the needs of the Department of Anthropology and Anatomy, IEMPAM - BAS, published in the State Gazette issue no 43/10.06.2022

Assistant Professor Diana Hristova Toneva is the only candidate in the announced competition. She has presented in detail and precisely the necessary documents according to the requirements.

She is born on May 21, 1982 and is graduated as a biologist – master of general anthropology in the University "Kliment Ohridsky", Faculty of Biological Sciences, Sofia, Bulgaria in 2005. Her professional development follows all the steps of academic realization: 2006-2010 – a regular PhD student at IEMPAM – BAS, Sofia; 2009-2012 – a biologist and an assistant, 2012 – and currently – Senior Assistant in the Department of Anthropology and Anatomy, IEMPAM – BAS, Sofia. She is engaged in research work mainly in the field of physical anthropology. In 2010, the candidate successfully defended the dissertation on the acquisition of a scientific and educational degree "Doctor" in the specialty "Anthropology" 01.06.01 on the topic: "Anthropological characteristic of the sternum, clavicle, scapular and proximal end of the shoulder bone and evaluation of their intersex differences".

Diana Toneva has 68 scientific publications in Bulgaria and abroad. She is the first author at 30 of them, which shows her personal contribution and active role. For participation in this competition are presented 18 scientific publications -14 in scientific journals with impact factor (IF) and 4 – in journals with impact rank, as well as 1 chapter of a book. She has participated in 41 scientific forums - 29 in Bulgaria and 12 abroad, with a total of 71 reports and posters presented.

The main scientific interests of D. Toneva are in the field of forensic anthropology, virtual anthropology and macroscopic anatomy. Using 2D and 3D imaging, it explores sexual dimorphism in human skeleton bones, thicknesses of soft facial tissues in connection with facial reconstruction techniques on the skull, reliability and accuracy of measurements on virtual bone models, as well as the manifestation, etiology and clinical significance of various anatomical variations.

The main contributions of a scientifically applied nature, reflected in her scientific papers, are developed models for determining the biological gender by bone remains. These models make it possible to establish gender based on the metric characteristics of the skull and separate bone

structures [1,2,3]. All of them are developed for a current Bulgarian population, using three-dimensional images of a skull and data on three-dimensional coordinates of a series of craniometric points. The application of machine learning methods is an approach that has entered the field of forensic anthropology in recent years. The use of supporting vector machines and artificial neural networks provides extremely high accuracy of models (over 95%) [1]. Classical analyses have been applied in the development of gender models by metric characteristics of the mastoid [2] and foramen magnum [3] and the results obtained show that the mastoid provides significantly greater accuracy for determining the gender. Some of the scientific papers are dedicated to examining the thicknesses of soft tissues of the face, which are essential for their reconstruction on the skull. The influence of skinness, gender and laterality on soft tissues has been studied and their dimensions have been found to be most affected by the level of skinness [4]. In order to improve the collection of data on soft tissue thicknesses, a new approach has been proposed for their calculation based on the use of polygonal models of the skull and skin of the face. The calculation of the distances between the two surfaces is carried out by the M3C2 plugin in the Cloud Compare computer program, which allows the extraction of data on the thicknesses of soft tissues at any point on the facial part of the skull. The total number of estimated distances amounts more than 70 thousand measurements for a pair of skull-skin. This approach also allows for an excellent visualization of soft tissues on the polygonal model of the skull [5]. The influence of age on the microstructure of cranial seams was studied using three-dimensional images of a skull obtained by industrial computed tomography. Morphological changes were followed and stereological indicators were calculated indicated the reorganization in the area with ages [6].

In the field of virtual anthropology, the reliability and accuracy of digital measurements on three-dimensional models of human bones, in particular a skull, have been studied. The results show that high-resolution three-dimensional models can be used as a reliable source of metric data for various anthropological and anatomical studies. The accuracy of reading points type 1 and 2 has been found to be more influenced by resolution and, at type 1 points, by the presence of texture. Type 3 points have the least precision in locating them on 3D models, but the resolution and texture of models are not factors that influence the error in reporting this type of points [7]. The accuracy and reliability of standard skull sizes measured on three-dimensional models generated by laser scanning have also been studied. The results showed that much of the digital and direct measurements were comparable, with small differences in their values [7.8]. The influence of the position of the skull on the dimensions of the frontal sinus in digital radiography has been studied. The most reliable dimensions of the sinus were found to be lowered in the Caldwell projection and any deviation from this position affected the accuracy of its dimensions [9].

Studies on anatomical variations of the skull, which track their etiology and clinical relevance have scientific and theoretical contributions. The research on a series of skulls of grown individuals with persistent metopic seam, for which three-dimensional models obtained by laser scanning and industrial computed tomography were used are of great interst. Original results are obtained by applying digital morphometric analysis, analyses from geometric morphometry and algorithms for extracting data patterns. By applying digital morphometric analysis, some specific features in the size of the skulls with a metopic seam and in particular in the area of the frontal

bone and nasal bones have been demonstrated [16,17]. Differences in the shape of the brain part of the skull were found when comparing series with and without preserved metopic seam [18]. The results obtained provide new data on the influence of the metopic seam on the shape and size of the skull. The methods of extracting data patterns help to study the relationship between the presence of a metopic seam and other anatomical variations of the skull, with the more frequent presence of additional bones in metopic skulls [16]. A chapter of a book published by an international publishing house also describes the relationship between the presence of a metopic suture and the pneumatization of the frontal sinus, and a comprehensive overview of the literature was also made [19]. Original results were obtained in the study and other anatomical variations of the skull, which are reflected in scientific papers dedicated respectively to the absence of foramen spinosum [10], the presence of additional bones in the scale of the occipital bone [11], the presence of a two-line condyle of the lower jaw bone [12], the presence of multiple army bones organised in a mosaic model [13], the presence of coastal bone in combination with a persistent metopic seam [14], premature closure of the scaly seam [15].

D. Toneva's scientific metrics are: 168 citations of 38 of the publications, 84 are in the SCOPUS database (reference from 05.09.22). She participates with 40 citations of 14 publications for the current competition. The total IF of the publications is 16.879 – after correction of the IF for one article and individual IF –3.909. According to journal quartiles (Scopus or WoS), publications are distributed as follows: 4 are in Q1, 8 are in Q2, 5 are in Q3 and 1 in Q4.

Assistant Professor D. Toneva has an active participation in 6 scientific projects. He is the head of one project under the Research Funding Competition – 2017, funded by the Research Fund of the Ministry of Education and Science, and one project under the Programme for Support of Young Scientists at BAS. She participates in the scientific teams of three other projects funded by the Research Fund of the Ministry of Education and Science and is a member of the target group of one project under the Operational Program "Human Resources Development". Her successful work in a collective, collegiality and correctness is evident.

Assistant Professor D. Toneva is a member of the Bulgarian Anatomical Society (BAD) and European Anthropological Association (EAA). In 2021, she receives an award "D Professor Dimitar Kadanov" for publication activity in the period 2019-2021. This vocation confirms her activity, ambition and purpose of a young and promising young scientist.

Conclusion: On the basis of the above facts, taking into account the scientific developments, achievements and contributions objectified by the science-metric parameters, I am convinced that the assistant professor Diana Toneva is an established and promising young scientist and researcher. She fully meets all requirements for taking up the academic position "Associate Professor" at the Department of Anthropology and Anatomy, IEMPAM – BAS, Sofia. I propose to the members of the highly respected Scientific Jury to support the candidate and to accept a positive proposal to the Scientific Council of IEMPAM- BAS, Diana Toneva to be elected as "Associate Professor" in the scientific specialty "Anthropology".

Sept. 29, 2022

Sofia

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