MOLECULAR BIOLOGY, HUMAN DEVELOPMENT AND ART HISTORY - REFLECTIONS ABOUT THE "HUMAN GENOME" MONOGRAPH (DR. GEORGETA CARDOŞ AND PROF. DR. DR. ALEXANDER RODEWALD)

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Abstract. The Human Genome monograph, represent the collaboration results between of two genetics: Miss Dr. Georgeta Cordoş (Bucharest, Romania) and Professor Alexander Rodewald (Hamburg University, Germany). Using the molecular genetics methods, developed in the studies over the human genome, the two genetist analysed the nucleotide sequence in nuclear-DNA and mitochondrial-DNA, from human vestiges belonging at 50 populations from the actual Romania territory in Bronze (22 populations) and Iron Ages (28 populations). The marker gene analysis at antiques populations and actual populations from the Romania territory, as well as in actual populations from neighbouring populations, permit the established the kinship degree of the Romanian population with the other European populations. These researches can be applied in different domains. Thus, the authors of these review, discussed the some features artistic preoccupations at the antiques human populations (Bronze and Iron Epochs) from the actual Romania territory, aspects which support the ancestors of the Romanian people in this territory.

Keywords: Human genome, paleogenetics, human populations, Romania territory, Bronze Age, Iron age.

Rezumat. Biologia moleculară, dezvoltarea omului şi istoria artei – reflecţii asupra monografiei „Genomul Uman" (Georgeta Cardoş şi Prof. Dr. Dr. Alexander Rodewald). Monografia **Genomul uman**, este rodul colaborării dintre doi geneticieni: doamna Georgeta Cordoş (Bucureşti, România) si reputatul profesor Alexander Rodewald (Universitatea Hamburg, Germania). Utilizând metodele geneticii moleculare, dezvoltate în studiile asupra genomului uman, cei doi geneticieni au analizat secvenţa nucleotidelor din constituţia genetică (DNA-nuclear şi DNA-mitocondrial) din vestigii umane aparţinând la 50 populaţii care au trăit pe actualul teritoriu al României în epoca bronzului (22 populaţii) şi epoca fierului (28 populaţii). Analiza unor gene marker la populaţiile străvechi din acest teritoriu şi la polulaţia umană actuală de pe teritoriul României, precum şi la populaţiile umane din ţările europene învecinate, a permis stabilirea gradului de înrudire dintre cele două populaţii de pe teritoriul României, precum şi înrudirea populaţiei române cu alte populaţii din Europa. Cercetările efectuate pot prezenta o valorificare în variate domenii. În acest sens, autorii prezentei recenzii, prezintă particularităţile unor preocupări artistice la populaţiile umane străvechi (epoca bronzului şi fierului) de pe actualul teritoriu al României, aspecte care sprijină prezenţa strămoşilor poporului român în acest teritoriu.

Cuvinte cheie: Genomul uman, paleogenetica, populaţii umane, teritoriul României, epoca bronzului, epoca fierului.

REVIEM: HUMAN GENOME

Subtitle: Researches of molecular paleogenetics at the old populations from the Bronze and Iron Ages from Romania territory - the evidence of genetic relationships with the Romanian population and with other actual European populations.

Authors: Dr. Georgeta CARDOŞ, Prof. Dr. Dr. Alexander RODEWALD, 2013. Edit. Teocora, Buzău, 156 pp.

The editing of this study is due to two specialists in genetics, Dr. Georgeta CARDOŞ – Scientific Director in Medical Genetics Centre "*Personal Genetics*", Bucharest, Romania, and Prof. Dr. Dr. Alexander RODEWALD, Director, Institute of Human Biology, Hamburg University, Germany. The entire title of this monograph study is: **HUMAN GENOME. Researches of molecular paleogenetics at the old populations from the Bronze and Iron Ages from Romania territory - the evidence of genetic relationships with the Romanian population and with other actual European populations**.

Their efforts conducted at the publishing of one of the few studies of paleogenetics, a new and recent field science. Paleogenetics is a border science, resulted from the joining of the field and work methods of two different sciences: molecular biology and genetics (work mainly on the molecular markers of DNA provenance) and palaeontology (study of the relations between ancient organisms and their link to present organisms).

In this monograph study, the authors achieved a molecular study on ancient and current population from the Romanian territory, in order to establish the molecular features of DNA in ancient and actual populations, as well as the relationship degree between these populations.

This monograph study represents (probably) a synthesis of the Doctoral Thesis elaborated by Mrs. Dr. Georgeta CARDOŞ under the supervision of Prof. Dr. Dr. Alexander RODEWALD: Cardoş G., 2008 – Molecular genetic study (mitochondrial and nuclear DNA) on old and modern human populations from Romania and their genetic relationship with other human populations from South Europe, PhD Thesis). This study is preceded by two prefaces, one signed by Dr. Napoleon SĂVESCU, president of "Reînvierea Daciei" International Society, and the second signed by the two authors. The proper study is structured in five chapters, accompanied by two appendices, references and abstract (in English).

Chapter one: **Human genome**, structured in seven sections, presents in the first sections concise information about ***DNA molecule***, ***Nuclear genome***, different ***DNA polymorphisms***, ***genic sex identification with the amelogenin gene***. In the subsequent section, ***Mitochondrial genomes***, there are offered ample information from this area

accompanied by explicit figures, concise information regarding the mitochondrial DNA variation in human populations in different continents, as well as a synthetic table regarding mitochondrial haplogroups identified in human populations from all over the Earth. In the last sections, there are presented selective information regarding the ***The origin, evolution and spreading of the modern homo*** and ***The origin of the actual European genetic background***. As genetics is a science with a dynamic and explosive development, there have been published numerous new information in the recent years (as a rule, the information after 2000 year), which are very interesting for the readers.

In the second chapter, **The paleogenetics – the study domain of the ancient DNA molecules**, there are presented and discussed pertinent aspects from the paleogenetics field, at the development of which both authors bring an important contribution. This chapter is structured in five sections: ***Introduction***; ***Degradation process of ancient DNA molecules***; ***Extraction of ancient DNA molecules***; ***Results authenticity***; ***Biological contamination of ancient biological proof with modern DNA* (*in the archaeological site or in laboratory*)**. The concise presentation of these aspects is important in order to establish rigorous work parameters for the elimination of some possible mistakes. The first palaeogenetic attempts were performed by the Chinese researchers at Hunnan Medical School, which extracted ancient DNA from a chop cartilage from "the Old Lady of Mawangtui" (a mum), 2,000 years old (HUMMEL, 2003). The founder of paleogenetics is considered the scientist Svante PÄÄBO (Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany), who extracted and cloned DNA from Egyptian mums (1985) and cloned the nuclear and mitochondrial DNA from other humanoid genotypes (*Homo neanderthaliensis*, *Homo sapiens fossilis*, *Homo denisovan*, a.o.), inclusively from Romania territory (Homo Cro-Magnon, from Peştera cu Oase, Fig. 1), (PÄÄBO, 1989).

Many scientists used the term **molecular palaeontology**.

Molecular palaeontology studied the recovery and analysis of DNA, proteins, carbohydrates, or lipids, and their diagenetic products from ancient human, animal, and plant remains (MAROTA & FRANCO, 2002; BOARDMAN et al., 2008; MORRISS, 2009). The field of molecular palaeontology has yielded important insights into evolutionary events, species diasporas, discovery and characterization of extinct species. By applying molecular analytical techniques to DNA in fossils, one can quantify the level of relatedness between any two organisms for which DNA has been recovered. Advancements in the field of molecular palaeontology have allowed scientists to pursue evolutionary questions on a genetic level rather than relying on phenotypic variation alone. Using various biotechnological techniques such as DNA isolation, amplification, and sequencing, scientists have been able to gain expanded new insights into the divergence and evolutionary history of countless organisms.

The third chapter is devoted to the presentation of the **aim of this paleogenetics study**. These consist in:

- Analysis of the genetic variation in the ancient human populations from the bronze and iron periods;
- The relations between ancient and current populations from the Romanian territory.

Also, the authors investigated if mitochondrial and nuclear DNA is present in the human individuals from the bronze and iron periods; the implication of genetic variation in human population; the genetic relation between ancient and current human population from the same territory (Romania country), as well as the genetic relation of the ancient population from Romania territory and other populations from South-East Europe. In this tackle, there are present many variables as population migration and others.

In fourth chapter, there are discussed **Materials and methods** used in this study, being structured in three big sections. After a short Introduction, there are presented the Materials represented by human ancient proof (from the bronze and iron periods) and biological proof from the Romanian present individuals. The ancient human proofs from the early and middle bronze period (3,500 – 1,600 a.Ch.), which were molecularly studied, come from 22 individuals and prevailed from different archaeological sites from the East, South-East and South of Romania, belonging to the following cultures: Early Bronze, Iamnaia, Sabatinovka, Catakombnaia, New Culture or Tei, Monteoru, Foleşti, Zimnicea, and Zimnicea.

The biological proofs belong to 28 ancient human individuals, from the iron period (1,200 – 650 a. Ch.), Hallstatt Epoch (Babadag and Basarabi cultures). These biological proofs were represented through: teeth (molars, premolars and canines), mandible and maxilla, or vermis.

The biological proofs from the current Romanian populations performed from two century blood proofs, come from actual human population. From these proofs, it was analysed the DNA microsatellite VWA31A marker, as well as the DNA at mitochondria level for 22 individuals. The individual proofs for the actual Romanian population was completed through the use of 92 mt-DNA sequences (for speciality literature).

Section **Work methods**. In paleogenetics researches, there were used molecular methods (PCR technology, DNA sequent ion, Southern blot, a/o), adapted to the degradation degree of the biological matter. The authors present the caution criteria for the DNA contamination prevention, the aseptic spaces, as well as different techniques used in their researches: polymerase chain reaction; DNA amplification through PCR technique; the markers of mitochondrial amplified through PCR technique; DNA electrophoresis; DNA sequent ion; the purification of PCR products and others. All these investigations were made using the material basis of the Institute of Human Genetics, Hamburg University (Director, Prof. Dr. Dr. Alexander RODEWALD, one of the co-authors and doctoral supervisor). The values obtained from the analysed DNA were used for performing a DNA bank with the three sources of human populations: ancient bronze, ancient iron and actual human. Their analysis was made with the help of different methods, an analysis of intra-population analysis: the haplogroups and haplotype diversity, number of polymorphic sites; molecular indicators; phylogenetic networks; Tajima test for selective neutrality; square chi test; the genetic distance between populations (F_{ST} distance; Nei genetic distance; Cavalli-Sforza distance); the phylogenetic tree constructed, the principal component analysis, a.o.

The fifth chapter, **Results and discussions,** is together with the previous chapter, the big part of this study. In this chapter, there are presented and argued the study results and the work hypothesis are substantiated. This chapter, which also contains the conclusions of the study is structured on four parts.

In the first part ***The analysis at the intra-population level***, there are presented the genetic analysis (nuclear and mitochondrial DNA) of the individuals from the ancient populations from the actual area of Romania, in comparison with the mt-DNA from the present population. There are also discussed the analysis of different markers (VWA31A satellite marker, HVR I and HVR II mitochondrial regions, amelogenin gene, some markers from the Y-chromosomes, a/o).

In the second part, it is presented ***The analysis at the inter-population level***, at mt-DNA and nuclear DNA. There are discussed the population differentiation, selective neutrality, molecular variance, analysis of the constructed molecular-tree, phylogenetic distance between these molecular-tree, as well as the Principal Component analysis. The phylogenetic analysis of the constructed markers-tree point out and reveal the affinities between the analysed DNA-samples. Thus, both in the phylogenetic-tree obtained through genetic distance after Nei formula, or after Cavalli-Sforza, the ancient populations from Romania are related with the populations from Italy, while in the same phylogenetic-tree for the modern populations, there are affinities between Romania and Germany populations explained through population migration in Central and East Europe (personal considerations).

In the third section, ***Discussions***, there are augmented and analysed the obtained results after the nuclear-DNA and mt-DNA analysis. This section is linked, as importance and content, with the last section, **Final conclusions**.

Final conclusions. The analysis of the results from this monographic study of paleogenetics, reveal a small genetic variability (both at nuclear-DNA, and at mt-DNA level) in the ancient populations from the Bronze Age and Iron Age, in the populations from the present Romanian territory, in comparison with the neighbouring ancient or current populations. This can be due to a well social organization of the ancient populations, supported by the presence of many cultural communities, each of them with a proper specificity in this region (personal consideration).

Regarding the genetic relations of the present Romanian population with other populations from this European region, the actual Romanian population formed a cluster together with the population from Bulgaria, as well as with the present population from Italy and Greece, appearance supported by historical arguments (personal considerations). The authors consider that "the genetic relationship between the ancient populations from Romania and modern European populations found in this palaeogenetic study is probably more complex; historians, archaeologists, anthropologists will help us find them" (CARDOŞ & RODEWALD, 2013).

At the end of this monograph study, the authors present two appendixes. Their analysis permits the specialists a direct access to experimental values. In the first appendix, with 25 figures, there are presented the gels of PAA with the position of different alleles of the VWA31A marker. In the second appendix, in five tables, it is presented the biometrical analysis for different human populations.

References contain 195 indices.

Abstract (in English) presents a major role in mass dissemination of the obtained results.

SCIENTIFIC APPLICATIONS

Based on the results of these researches, from this monograph, we make a foray in human history populations from the actual Romania territory and his artistic preoccupations.

This analysed book presents a monograph feature. Although it is a scientific book, the scientific information is attentively dosed and adequately presented, and, thus, it can be used by an interested or a specialist reader. The scientific information can be used by different specialists in their work field. In this book, it is augmented the Romanian people existence, with a distinct genetic entity, as well as our relations with the neighbouring populations. Sincere greetings to the two authors and pleasant reading to you all.

In some photos selected from the speciality literature there are presented some artistic achievements of the inhabitants, which lived some millenniums ago on the present territory of Romania (Figs. 2 - 6). The artistic creations and activity of the populations from the Bronze and Iron Ages from the current Romanian area point out a big development.

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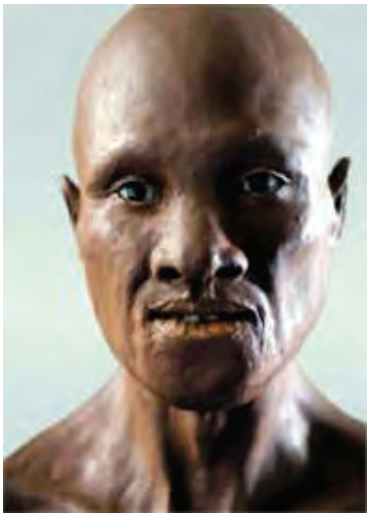

Figure 1. Peştera cu Oase, inhabitant Cro-Magnon. 35,000 years Reconstituted by Richard Neave (2009). (Paleolithic).

Figure 2. Venus of Craiova (female torso) Small Salcuţa Venus, Sălcuţa culture. 15,000 – 10,000 a.Ch. (Aeneolithic).

Figure 3. Plate with cuneiform letters, Tărtăria, 5,300 a.Ch. (Neolithic).

Figure 5. Receptacle, Cucuteni-Trypillian culture, 4,800 – 3,000 a.Ch. (Neolithic).

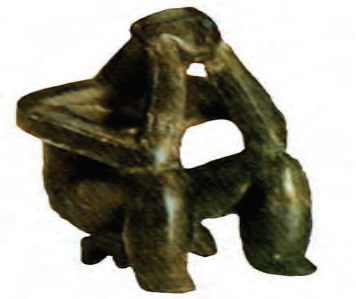

Figure 4. Thinker of Cernavodă, Hamangia culture. 5,250 – 4,550 a Ch. (Neolithic).

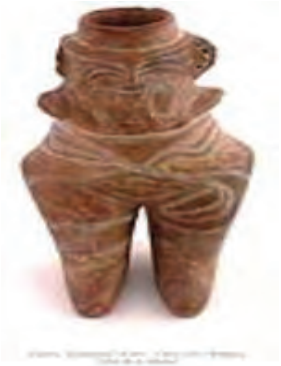

Figure 6. Goddess from Sultana, Gumelniţa culture. 4,400-3,950 a.Ch. (Neolithic) (GHEORGHIU, 2012).