

FOREWORD

S.D. Varfolomeev and G.E. Zaikov

"You shouldn't be a motiveless optimist to believe that fifty years later the 'biological code'—chemical encryption of hereditary features—will be decoded and read. Since that moment, the man will become the absolute sovereign of the living matter."

V.A. Engelgardt, 1957

"The man will not become the lord of the nature until he will not become the lord of himself."

G. Hegel, 1807

The Academician V.A. Engelgardt has rather accurately predicted the time of performance of the outstanding event in the history of mankind—decoding of the human genome. If you call to notice that this prediction was made just three and half years after discovery of DNA as the informative molecule carrying genetic information, one may only be surprised about sagacity and scientific intuition of the Academician V.A. Engelgardt.

During fifty years, science has made a terrific experimental and theoretical academic breakthrough that by the beginning of new millennium provided decoding of human DNA genome molecule structure, and genome of many microorganisms, plants and animals, as well. At present, the structures of DNA genome for more than 500 organisms are determined. This process is in progress, and its intensity and information received avalanche-like increase.

Besides deep admiration of achievements of the science and display of power of the global human intellect, what does this give to the modern society?

Decoding of genomes has many consequences, and a lot of them will be continued and developed in recent years or decades.

Decoding of the human genome creates a qualitatively new state in development of modern fields of science, technology and medicine. One of the basic results of the Human Genome Project, which are already comprehended, is formation of a basis for investigating genome of every individual with detection of differences at the gene and protein levels.

Chemical-biological approach based on highly efficient physical methods provides opportunities of detailed molecular genetic typing of the population, investigation of genetic polymorphism, individual features of enzymatic and molecular-receptor processes in every person. Achievements in human genomics and proteomics, chemical enzymology,

bioinformatics and medical genetics form the basis of modern investigations and multiple practical uses. The accuracy and efficiency of modern analytical methods allows for assigning tasks of obtaining genetic and proteomic molecular portrait of every individual and detection of individual differences of personalities at the genetic and protein levels. In the nearest decade, post-genomic and proteomic investigations will lead to significant changes in many spheres of social life.

At present, qualitatively new molecular medicine based on determination of the ultimate causes of many diseases is being established. Aptitudes and development of many diseases are genetically defined. Basing on post-genomic and proteomic studies, new branches, such as cardiogenomics, oncogenomics, neurogenomics, pharmacogenomics, based on objective appraisal and reduction of risks of cardiovascular diseases and cancer, forecast of neurodegenerative processes and aging appear in medicine. Today, it is referred to as creation and development of individual medicine based on molecular-genetic and proteomic human portrait.

Occupational guidance and study of personal dispositions in various spheres of action may be based on molecular-genetic analysis. Molecular genetic typing is the foundation for reasonable determination of potential occupational abilities of a man. The study of polymorphism of genes defining physical, psychological and intellectual human characteristics seems to be of crucial importance.

In the modern post-genomic process, one of the main targets is creation of a unified platform for genetic analysis and the basis for genotyping of the population. Functional reserves of the human organism are significantly defined by the genotype of parents. At present in developed countries, and in the nearest future in Russia, a system for estimation of risks and abilities of children basing on genetic portrait of parents is being developed. It is expected that in full, this system will start functioning in the nearest decade. Genetic forecasting of pathology risk and human abilities at the background of many social factors is the material basis for transition to genetically healthful population.

Post-genomic projects suggest many special supplements; in particular, developed approaches provide full and unambiguous identification of an individual using superlow trace quantities of biological materials.

The molecular genetic approach becomes the foundation for many human sciences. Analysis of structural features of genomic DNA passed from generation to generation is fundamental for the modern approach to the study of origination and evolution of ethnoses. New fields of science, ethnogenomics and ethnogeography appeared.

Post-genomic development of the science touches upon many spheres of life of the modern society. Basing on molecular presentations created by modern physical, chemical and molecular biological methods and operating modern information technologies, which use an advanced mathematical apparatus, this field creates extremely socially meaningful products affecting development of the society as a whole.

The problem of studying molecular polymorphism of a man is interdisciplinary and interesting for investigators in various branches. Recognizing the multilevel and interdisciplinary kind of the problem, in 2006, Russian Academy of Sciences and M.V. Lomonosov Moscow State University established a joint project aimed at solution of many problems, coordinated around the study of the multiformity of human biomacromolecules. The book suggested is the result of the first stage of development of this project. Workers of many scientific organizations in Russia took part preparation of this book.

Understanding of the modern methodical level of investigations of the same gene variety at the level of genomic DNA and expressed protein structures seems to be of principal importance. Methodology of the investigation includes various methodical approaches and physical observation methods that allow detection of differences in the gene structure, including, at the level of singular substitution of nucleotides. Of importance are detailed analysis and application of modern high sensitive, precise and highly productive methods based on mass spectrometry of biomacromolecules in this field.

A number of key systems such as full system of enzymes or ribosomal RNAs existing in the human organism require analysis and understanding of the molecular variety affecting human molecular physiology. The questions about the role of structural modifications and singular substitutions in the structure and function of macromolecules may be answered both at experimental and theoretical stages of the investigation. The important role of modern computation and information technologies in the analysis of the role of singular substitutions, heritable and stable in the human population, should be emphasized.

Human aptitudes to some diseases are genetically determined. On the example of analysis of the literature and self experimental data, the role of genetic and proteomic polymorphism in development of ischemic heart disease, liver diseases, bronchial asthma, habitual noncarrying of pregnancy, etc., is discussed in this book. The investigations of genetic control of carcinogenesis and mutagenesis are of the greatest importance and interest. At present, genetic aspects of psychology, type of psychological behavior, personality of individual, and psychoemotional behavior are the subject for molecular-genetic and proteomic analysis.

Actually, molecular genetic methods of personality identification is of high practical significance. A special article in this book is devoted to the aspects of forensic genetics.

Amazing results were currently obtained on genetic history of the mankind recorded in some DNA-markers. Polyethnic structure of the population is the specific feature of Russia.

Molecular kinetic methods allow clarification of complex problems in intercommunication of different ethnoses in Russia. This is hard work lying on the shoulders of Russian researchers of ethnic genomics and genogeography. Modern results obtained in this field are shown in the final section of this book.

Thus, the reader gets the book introducing him into the world of ideas and results oriented at the post-genomic development of the society. This is the book devoted to molecular polymorphism of man based on structural multiformity of biomacromolecules. Achievements of many branches of the modern science—physics and chemistry, biology and medicine, mathematics and informatics—and many human sciences, fancily and incredibly intersect in this field. This field is extremely socially significant, because it touches upon every individual. The nearest decade of the post-genomic era will give many interesting and unexpected achievements.

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S.D. Varfolomeev, MSU Professor, Corresponding Member of RAS

G.E.Zaikov, Professor, Institute of Biochemical Physics RAS