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At the beginning of the 19th century only 3 per cent of world population lived in the cities. By the mid-1970s the urban population totaled 65 per cent in Europe (USSR excluded), more than 75 per cent in North America and 85 per cent in Australia and Oceania. In some countries this figure was more than 90 per cent (West Germany).¹ Cities become the main place of residence and regularly increasing number of people is born, live and die there. Does human biology change in the cities? Do certain groups of basically rural people retain their specific features?

Many publications address only specific aspects of this problems, such as physical traits of urban and rural populations, differences between people living in the cities with light and heavy industries and between city born and the first generation of migrants to the cities. At the same time, a more general question of genetic characteristics which change under the influence of urban life has been discussed to a lesser extent.² This paper considers the urban environment as a new force that purposefully changes the image of human race and forms a new biological structure of the Homo Sapiens.

History shows that disintegration of tribal community and emergence of commodity production involved mass migrations from rural to more economically favourable areas. These areas were the focus of craftsmen, clergy and upper administrative crust. All these sections belonged to different clans. Biologically, a clan constituted a gene, or a structure governed by laws of population genetic. Various types of mixtures can occur during migrations: the males of one population marry women from another population, and the males of the latter are totally exterminated; two populations

exchange spousal partners; a section of a first population is fully assimilated by the second one, but the first retains

Its peculiarities, the gene pool within the borders of their previous habitation and so on. In the city marriages are made between people of different clans and populations and are not based on kinship (as in the clan). They are rather determined by social status. At first sight, a city constitutes a simple mechanical mixture of individual representatives of different gene pools. If a migration is protracted and the resultant mixture exists for several generations, it would be logical to speak of specific processes leading to the formation of a new mixed anthropological type. Modern genetics has discovered that a city, which integrates individual representatives of various gene pools from nearby areas, with the passage of time increasingly reproduces the total of respective gene pools. Moscow population, for example, which for many centuries was genetically linked with the indigenous population of central Russian areas still retains similarities with the latter. At the same time, the increase of migration from eastern and southern areas (in the 19th century all migrants came to Moscow from regions located in the 230 km area; in 1955 the area, expanded to 560 km and in 1980 to 1100 km), intensifies national and genetic heterogeneity of Moscow. Moscow “increasingly reproduces the gene pool of the entire country”.³

Heterosis is one of biological consequences of such a mixing. It has long been observed in the cities in the form of acceleration, but now this process is on a decline.⁴ Numerous studies show that the structure and body weight, head dimensions and the cephalic index (brachycephalization) of the urban population are bigger than that of the rural one.⁵ Similar

increase of the cerebral and facial skull is suggested by the medieval craniological material of the urban cemeteries in Russia.⁶ It seems that mixing is not the only factor involved in such changes. Some publications note that migrants have an extreme morphological position in their native populations. They are more robust, the size of their heads and bodies is bigger, and have better physical development.⁷

If only a section of a population migrates, than it seems, the gene pool of the population would not be completely reproduced. As was noted, migrants to the city are individuals and small groups from rural areas, and it is logical to speak of the founder effect.

In addition to the specific type of migration and mixing, there is one more factor that exerts influence on man in the city. This is a combination of natural and artificial environment. The latter is most pressing in the city. Indeed, urban residents in Soviet Central Asia and the Far North are influenced by such climatic factors as temperature, atmospheric pressure, air humidity, and this influence is different. At the same time, these influences are modified by artificial environment: heating or air conditioning; apartment houses occupying a relatively small area, asphalt pavements of streets. Running water in the city considerably differs from that in the countryside. Which is explained by disinfecting chemical additions, various types of piping and so on. The air in the city is not as salubrious as in the village either.

Food is one of the most important medium via which the environment affects man. We must primarily note that food is brought to the city from different regions, including very remote ones. That is why it is more diverse than food in the

nearby rural settlements. In addition, food in the urban environment becomes increasingly artificial owing to various additions to natural products and synthesis of special compounds which are close to natural products in taste and biochemical composition.

Cities, more than villages, are affected now by increasing environmental pollution. Water, air and soil accumulate microelements which, in most cases, are artificial to nature. However, T.I. Alekseyeva notes that the composition of inhaled air, microelements contained in the soil and some other factors involve adaptive changes of world populations.⁸

In the city, mutagenic pollutants may involve more intensive mutations than in the countryside. According to O.L. Kurbatova.⁹ Moscovites of the younger generation have more rare phenotypes than their parents. A group of scholars have noted very rare modifications of the locus P₁α₁-antitrypsin among Moscovites, which is identified only for a second time in the world.¹⁰ We do not know how strong and effective a selective pressure on these phenotypes will be and what consequences it will have. But now the growing variability of biological traits in the city is graphically demonstrated by these facts.

The density of city population is one more biological factor of great importance. As is known density increases suppress fertility of various animals. In human society, fertility strongly depends on social standards and requirements.¹¹ Available demographic data shows that in the major Soviet cities the birthrate is lower than in the countryside, constituting respectively 0.9 to 1.55 in gross

terms.¹² It should be noted that the birth rate became virtually similar in various cities in the 1970s.¹³

As far as world megapolises are concerned, they are marked by positive correlation between population density and mortality rate, tuberculosis invasion and men total disorder.¹⁴

Even this brief review suggests that the city is likely to become a specific ecological niche in which a special adaptive type is taking shape. Does a combination of natural and artificial environments affects humans in a specific manner? If it does, cities of different geographic location and history should exert influence and modify the biological features of humans in a similar manner. It is possible that the city, as a unique combination of random factors, exerts a haphazard and unpredictable impact on human biology. In this case, even closely located cities with similar history will be different in this sense.

However, the above data seems to support the first hypothesis. However, all the studies of human ecology deal with the adaptive changes occurring in the populations. If the most general definition of a population is applied to a city community, it would be clear that its representatives, as members of a single community, are distinguished by common territory and close ecological and social contacts. However, such an important feature as more close ties between members of a population than those between this and other populations usually is not observed in the city. In the city, there are more close social ties, but biologically, city residents often have close relatives outside the urban community. Children of the migrants of the first generation try to marry in the city or, at

least, region in which they were born.¹⁵ Given the intensity of migration,¹⁶ which indicates the limits of gene flow and stability of a community in a number of generations, a population must be defined as a combination of residents of several cities or other settlements which form urban conglomeration with intensive economic, labour, cultural and social relations. Some scholars believe that the city constitutes the panmictic centre of heterogeneous population.¹⁷ For this reason, people primarily marry within their national and socio-professional groups.¹⁹

If marital assortation is observed among the urban population, it means that the city constitutes both a socio-economic and a biological system. Could not it be a reason for similarity of population structure of Moscow and Siberia? This similarity was noted by Yu.G. Rychkov in a number of generations, their total time range and the ranges of individual generation, generation overlapping and distribution patterns of genetic indicators.²⁰ But the most important feature of any system is the emergence of new integrating qualities resulting from the interaction of constituent components. Does a new biological-anthropological quality evolve in the city? Or does the city constitute a unique formative factor? To give a clear answer to these questions, we must show that the urban environment does not only purposefully modify the level of occurrence of some features, but also creates a new morphophysiological system of these features as most adapted to the artificial urban environment.

If this thesis will be supported by factual evidence, the process of urbanization, that began several millennia ago, can be regarded as a fifth (within the concept of V.P. Alekseyev²¹)

stage of formative process within the Homo Sapiens. The leading factors of this stage are: (1) interaction involving not the entire (or large section of) gene pools, but their individual representatives, and (2) the formation of a new morpho-physiological system which is most adapted to the urban environment the larger portion of which is man-made.

We have given some evidence in favour of this idea. Regrettably, anthropological study of the city, involving morphological, genetic, physiological and psychological peculiarities is yet to be done. The available studies, interpreting the city as a local population, are based on random samplings. As was noted, the city should be examined as a complex system. To understand this system, we must analyze the variability of indicators for all the components of this system. A relevant sample should be made on the basis of socio-demographic data (territorial division of a city, socio-professional and age-sex distribution, uneven genetic contribution of migrants from various regions, the length of their residence in a city, ethnic composition, religious affinity). Naturally, we must first make a professional sociological and demographic analysis to be followed by biological analysis. A psychological study of the city coordinated to the above programs is also of much importance. This will help us establish mental responses and resistance to informational overstrain typical of the cities, and show the morpho-physiological determination of various psychotypes.

Special attention should be given to the complex character of the biological program. On the one hand, we must know the frequencies of a genetic marker to evaluate genetic processes and the level of genetic variability within the system

of populations. On the other, we must use the characteristics relating to various morpho-physiological systems of the organism which are controlled by many genes as most conducive to evaluating the stability of gene pool modifications and the expansion or reduction of standard responses of genotypes.

At the first stage it would be reasonable to conduct studies in two cities. One of them must be old and the other must be young, but the variability of its biological indicators in the three or more generations should be traceable.

Finally, I would like to stress the practical importance of such a study. At long last, medicine has become aware of the main thing. Diseases could not be effectively fought (and health will not be accurately predicted or prevented) without good knowledge of tendencies in the development of biological peculiarities of the entire human race and of its individual populations. If researchers will establish the identity (or the absence of it, which is unlikely), of changes occurring in the systems of human body and the evolvement of a new morpho-physiological system in the cities of various types and located in different zones, from the tropics to the temperate zones, it will help solve many problems of the contemporary medicine.

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