LEUKEMIA AND PERIODIC STRUCTURES OF HALO-FORMING CELLS

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Periodic structures formed as a result of long-distance interaction between microscopic objects have been described in colloid chemistry. These structures include hexagonal lattices of latex particles measuring 0.06 or 0.2 μ, located at similar distances from one another. Hexagonal packing of parallel rods of the tobacco mosaic virus (TMV) with a diameter of about 150 Å, located at a distance of 180-600 Å apart, also has been described [3].

Periodic structures consisting of leukemic blood cells, and located at a distance of 60 μ or more apart, i.e., two or three orders of magnitude greater than those described above, also have been found [4].

The aim of this investigation was to study interaction of halo-forming leukemic cells in periodic structure, with a view to their subsequent practical application.

EXPERIMENTAL METHOD

Periodic structures (PS) of halo-forming cells (HFC) were obtained as follows: a drop of blood (0.03 ml) from a patient with one form of leukemia (chronic lymphatic) was added to a mixture of concentrated sodium chloride solution (15%) with the addition of ink. The ratio of blood and solution in the mixture was 1:10. One drop of the mixture was placed on a slide and covered with a coverslip, whose edges were smeared with petrolatum [1, 2].

The formation of PS was monitored by means of an MBR-3 light microscope (LOMO, Leningrad) under different magnifications.

The degree of periodicity of the structure was calculated by the "Iskra-226" computer (USSR), by determination of the mean value and scatter of distances to the nearest cells in the zone of the hexagonal radius from a central cell, chosen arbitrarily within the photograph obtained.

EXPERIMENTAL RESULTS

After preparation of the specimen for microscopy halo formation was observed, initially from background ink particles (after 4-10 sec), but later from background erythrocytes (after 5-10 min). After incubation of the specimen at room temperature for 2-5 days, the beginning of PS formation was observed. In the course of 1 month, a stable periodic structure was basically formed. During observation of PS for 5-6 months, the dynamic nature of the state of the structures was noted. PS formation was determined by the state of the blood preparation in the mixture of hypertonic salt solution and ink. First, the specimen remained for a long time in a closed space, without access of air, in which some of the cells, mainly erythrocytes, were completely destroyed in the course of 2-5 days, and their contents leaked into the solution. Leukocytes were constantly exposed to the action of the hypertonic solution. The dynamic position of the PS, consisting of halo-forming and non halo-forming leukocytes, was determined by the fact that the process of gel formation took place in PS around some of the cells, with disappearance of the gel from other cells. New HFC were "attracted" to the mass of halo-forming cells located in PS, widening and deforming the network of PS. Groups of HFC, located in PS, underwent to-and-fro movement, modifying the structure of PS. This may be evidence of

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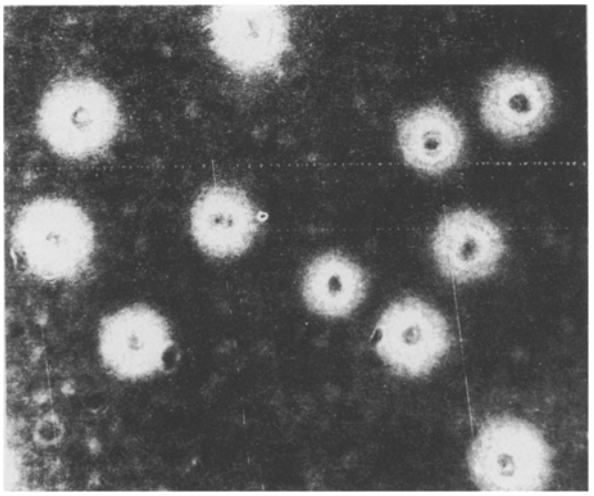

Fig. 1. Chaotic arrangement of cells. Ink. 400×.

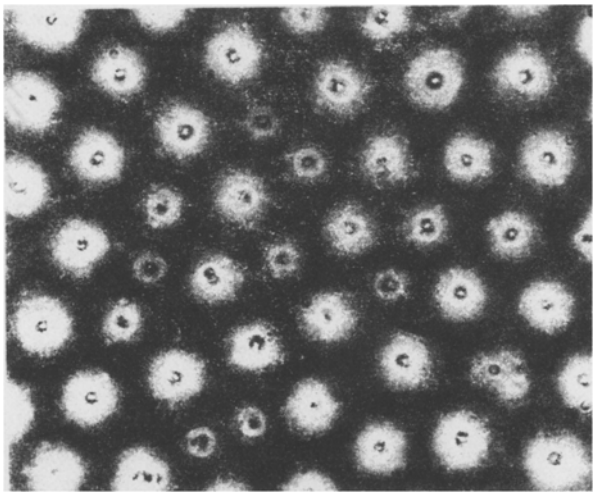

Fig. 2. Periodic arrangement of cells. Ink. 300×.

the action of forces (their nature has not been finally established), acting at different distances from the surface of the cells. Depending on the density of the cell suspension (after destruction of the erythrocytes) the mean distance between HFC in PS may reach 40-100 μ. The formation of PS of HFG took place from leukocytes initially distributed chaotically in the specimen (Fig. 1), but later, structures with a varied degree of periodicity were formed from the chaos (Fig. 2), and in some cases a high degree of periodicity was obtained (Table 1).

It follows from our previous experiments [2] that HFC in hypertonic solutions of an electrolyte have a negative electric charge (the Z-potential of HFC is 7.5 mV). On the basis of this fact we suggest that PS formation is due to interaction of electric charges on the surface of the cells, which determine the distance between them in PS also. Since under these conditions the process of ionic exchange of cells with solution continues, although at a slow pace, the charge on the surface of the cells changes, and this determines the dynamic quality of PS. On the basis of the absence of PS for healthy leukocytes in the same salt solution, we are inclined to suggest that PS formation is determined by the manifestation of electrical properties characteristic of leukemic cells. Our future research will be aimed at proving the connection between the course of leukemia and the degree of periodicity in the arrangement of leukemic cells, and also at improving the techniques of computer assessment of the degree of periodicity of structures of HFC.

TABLE 1. Assessment of Degree of Periodicity in Arrangement of Leukemic Cells on the Basis of Statistical Analysis of Distances between Cells

Degree of periodicity	Arithmetic mean and standard deviation, μ	Probability of significant difference between samples relative to difference of standard deviation
High	58,8±4,2	0,999
Av. (intermediae)	54,5±9,4	0,7
Chaos	49,1±12,7	—

LITERATURE CITED

1. M. V. Golovanov, Inventor's Certificate No. 930049 USSR; Otkrytiya, No. 32 (1976).
2. M. V. Golovanov, Author's Abstract of Candidate's Dissertation, Biological Sciences, Kiev (1984).
3. I. F. Efremov, Periodic Colloidal Structures [in Russian], Leningrad (1971).
4. B. V. Deryagin (B. V. Derjaguin) and M. V. Golovanov, Colloids and Surfaces, No. 10, Amsterdam (1984).

TRANSPLANTABLE XENOGRAFTS OF HUMAN CERVICAL CARCINOMA. CHARACTERIZATION OF HUMAN PAPILLOMAVIRUS GENOMES

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The link between papillomaviruses and human tumor pathology is one of the most important topics at the present time in oncovirology. The genetic information of human papillomaviruses (HPV) has been found by molecular-biological methods and cloned from cells of various human neoplasms, both benign and malignant. One of the latter is carcinoma of the uterine cervix (CUC).

More than 50 types of HPV genomes have now been cloned [12]. In human CUC cells, HPV of type 16 (HPV-16) has most frequently been found, but types HP-18, 31, 33, 35, and 39 also have been described [4, 5, 12]. According to evidence obtained [5, 12], DNA of HPV can be found in clinical specimens of human CUC with a frequency of between 34 and 90%. The oncogenic potential of DNA of HPV, and in particular, of HPV-16, is proved by the discovery of the sequences of this virus after transfection of DNA of clinical material of CUC into NIH/3T3 cells [14], and by the ability of the cloned HPV-16 genome to transform human keratinocytes and fibroblasts [8].

The oncogenic potential of HPV DNA and the frequent association of HPV with CUC suggest that papillomaviruses play a role in the oncogenesis of the epithelium of the uterine cervix. A penetrating study of this problem can be undertaken most effectively on model systems. The best known are eight cell lines of human CUC, contained in the American Type Culture

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