CYTOGENETIC CHARACTERISTICS OF TWO NEW TRANSPLANTABLE CELL LINES OF GRAY HAMSTERS (Cricetulus migratorius) TRANSFORMED BY ROUS SARCOMA VIRUS

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UDC 57.083.35:576.858.6.083.35.095.383

Transplantable cell lines KhRO-1 (2n-22) of the gray hamster Cricetulus migratorius, obtained from a sarcoma induced by Rous sarcoma virus (Carr–Zil'ber strain), and KhÉT-ASa, obtained from a culture of embryonic fibroblasts transformed by the same virus, had passed through more than a 100 passages at the time of cytogenetic investigation and exhibited heteroploidy, with different types of marker chromosomes, with an especially high percentage of dicentrics. The phenomenon of prolonged survival of dicentric chromosomes was found. Peridiploid and peritetraploid clones had selective advantages. Chromosomes of the 8-10 group (the smallest chromosomes of the set) were most often absent from cells with hypodiploid and hypotetraploid numbers of chromosomes.

Cell cultures from the gray (Armenian) hamster Cricetulus migratorius are of particular interest for virological and genetic research because under normal conditions they have only 22 clearly identifiable chromosomes [4]. The cytogenetic characteristics of cell cultures from this hamster transformed by DNA viruses AD-12, AD-18, OV-40, and SE-polyoma have been described in the literature [3].

A cytogenetic study of two new transplantable cell lines from the gray hamster transformed by RNA virus of Rous sarcoma is described below.

EXPERIMENTAL METHOD

Both cultures were obtained by Martirosyan in 1969 at the Institute of Experimental Biology (Erevan). In both cases Rous sarcoma virus (RSV, Carr–Zil'ber strain) was used as the transforming agent. The KhRO-1 culture was obtained from a tumor induced by RSV in gray hamsters 2 weeks old after triple subcutaneous injection of fowl sarcoma cells. The KhÉT-ASa culture was obtained from a culture of gray hamster embryonic fibroblasts transformed by RSV. At the time of the cytogenetic investigation the cultures had gone through more than 100 passages. Both cultures were free from the infective form of RSV. The method used for the cytogenetic investigation of the cell lines has been described previously [2].

EXPERIMENTAL RESULTS

Both cultures possessed a heteroploid karyotype typical of transplantable cell cultures (Table 1). Cells with 23 chromosomes, and with different types of marker chromosomes predominated in the KhÉT-ASa culture. Cells with 22 chromosomes as a rule were pseudodiploids, and they often contained one large, unpaired metacentric chromosome (Fig. 1).

Institute of Experimental Biology, Academy of Sciences of the Armenian SSR, Erevan. (Presented by Academician of the Academy of Medical Sciences of the USSR, N. N. Blokhin.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 72, No. 11, pp. 83-86, November, 1971. Original article submitted June 25, 1970.

TABLE 1. Karyological Characteristics of Transplantable Cultures KhÉT-ASa and KhRO-1

Strain	Total number of metaphases	Chromosomal aberrations		Cells with number of chromosomes specified below																								
		abs.	%	15–16	18–19	20	21	22	23	24–25	26–27	29–30	31–32	33	34–35	36–37	38–39	40–41	42–43	44	45	46	47–48	49	50–54	60–79	80–90	100–200
KhÉT-ASa	230	130	56,5	4	6	8	25	50	81	6	2	2	2	3	2	2	4	4	4	6	5	5	2	1	1	2	3	—
KhRO-1	1st investigation 400	158	39,4	—	—	4	32	188	91	6	2	2	—	—	1	3	2	5	13	36	2	3	1	2	1	2	3	1
	2nd investigation 237	164	69,0	—	—	1	9	39	25	13	1	2	1	1	1	6	2	9	30	42	16	9	5	—	1	5	10	9

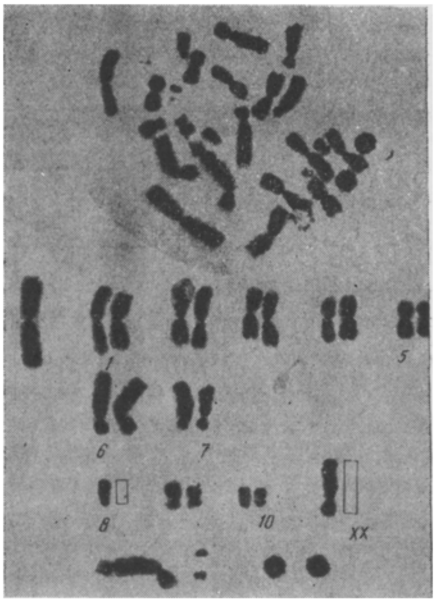

Fig. 1. Abnormal karyotype of cell of strain KhÉT-ASa. Large metacentric, haplosomy relative to the 8th pair of chromosomes, dicentric, and ring chromosomes.

At the first investigation cells of the KhRO-1 culture were predominantly of the 22-chromosome type, and only a few had a karyotype similar to normal, most being pseudodiploids with marker chromosomes and usually with a large unpaired metacentric, a large acrocentric, etc. Many of the cells had a hyperdiploid karyotype with nulli- and trisomy with respect to individual pairs of chromosomes and with several types of marker chromosomes (Fig. 2).

Karyological investigation of the two cultures revealed two interesting phenomena. First, there was a high frequency of dicentric chromosomes (30 per 100 cells in the KhÉT-ASa culture and 23 per 100 cells in the KhRO-1 culture). Individual cells with 3, 4, or even 5 dicentric chromosomes were seen. Of the 70 dicentrics found in the KhÉT-ASa culture, 55 were unaccompanied by fragments, while in the KhRO-1 culture 80 of the 90 dicentrics were not accompanied by fragments. Repeated investigation of the KhRO-1 culture at an interval of 1 month revealed no decrease in the number of cells with dicentric chromosomes. These results indicate that prolonged survival of dicentric chromosomes, which are usually eliminated very rapidly in a series of cell divisions, is a rare event. A study of the frequency of mono- and dicentric ring chromosomes unaccompanied by fragments in the two cultures revealed the stable character of the aberrations of this type also. Both phenomena are evidently the result of some distinguishing feature of the karyotype of the gray hamster in general, and of the investigated cultures in particular.

The second distinguishing feature of the cultures was the relatively high percentage of peridiploid and pseudodiploid cells (47% in the KhRO-1 culture). Cells with 21, 22, and 23 chromosomes were overwhelmingly predominant in the populations, and under these conditions they evidently had selective advantages over the aneuploid cells with a large number of chromosomes (Table 1).

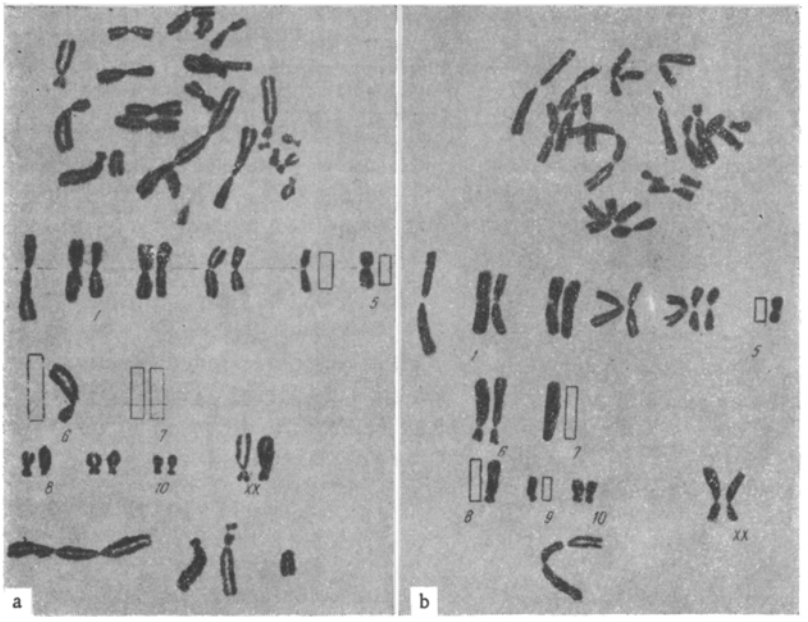

Fig. 2. Karyotypes of cells from KhRO-1 culture. Haplosomy in 4th, 5th, 6th, 8th, and 9th pairs of chromosomes (a). Nullisomy in 7th pair. Dicentrics and marker chromosomes. Trisomy in 3rd pair (b).

TABLE 2. Relationship between Number of Small Chromosomes (8, 9, or 10) and Ploidy of Nuclei in Strain KhÉT-ASa

Ploidy	Total number of metaphases	Metaphases with 8-10 small chromosomes		
		less than expected	more than expected	expected number (typical for gray hamster)
Diploids (22 chromosomes)	47	27	0	20
Hyperdiploids	123	57	6	60
Hypodiploids	43	25	6	12
Hypotetraploids	18	9	2	7

To determine the role of the different groups of chromosomes in the aneuploidization of the cultures, the content of easily identifiable small chromosomes (of the 8-10 group) was studied in the diploids and pseudodiploids, the hypodiploids, and the hyperdiploids (Table 2). The results showed that the number of small chromosomes (of the 8-10 group) in the hypodiploids, just as in the hypotetraploids, was less than expected. Consequently, the decrease in the number of chromosomes in these cells took place mainly at the expense of the small chromosomes (of the 8-10 group). This phenomenon can be explained in two ways: first, by the greater probability of mechanical loss of the small chromosome than of the large; second, by the smaller genetic value of the small chromosomes than of the large, which stems directly from the need for a certain balance between the chromosomes for the viability and selective properties of the cells [1]. A relatively high level of chromosomal aberrations was observed in both cultures, presumably on account either of anomalies of metabolism with the rapid progress of the cultures toward age destruction or of the presence of a biological agent in the cells of the cultures.

LITERATURE CITED

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