33. *Chromosomal Aberrations in cultured Human Leucocytes induced by Cadmium Sulfide*[*)]

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The induction of chromosomal aberrations in human leucocytes by various exogenous agents including sodium cyclamate, caffeine, and LSD has been studied extensively (Cohen, 1963; Obe, 1969; Vig *et al.*, 1970; Stone *et al.*, 1970; Ostertag and Greif, 1967; Cohen *et al.*, 1967). Cadmium compounds are chemicals known to have been the cause of the some of human diseases such as Itai Itai disease by enviromental pollution. It is important to know whether these compounds give damage to the genetic material of human cells. To determine this problem, we examined for chromosome damage of cultured human leucocyte cells treated with cadmium sulfide. The results of the observation are preliminarily described in this paper.

Material and methods. Human leucocytes from a normal female were cultured according to the routine phytohemagglutinin method. The cultures were incubated at 37°C for 72 hours, and during the last 8 and 4 hours of incubation cadmium sulfide (CdS) was added at the final concentration of 6.2×10^{-2} μg/ml of culture fluid. Control cultures were incubated at 37°C for 72 hours without addition of CdS. Colcemid at a concentration of 0.02 μg/ml was added to the cultures 3 hours before harvest in order to obtain metaphase chromosomes. Slides were prepared by the routine air-drying methods and stained with Giemsa. In each case, fifty well-spread metaphase plates were examined for the chromosomal analysis.

Finding and remarks

By treatment with CdS, several chromosome aberrations were induced. The aberrations such as chromatid breaks, isochromatid breaks, translocation, and dicentrics were included in the treated

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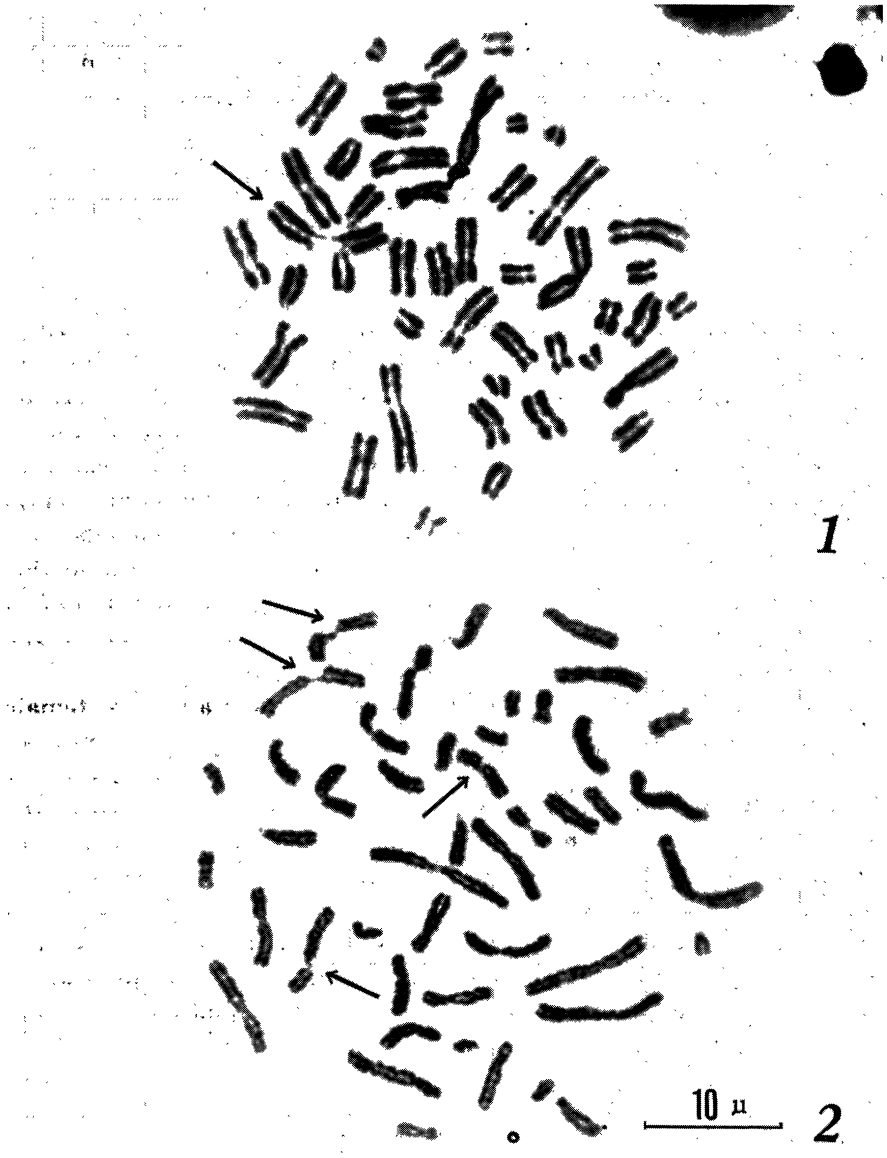

Figs. 1 and 2. Metaphase chromosomes treated with CdS.
1) Cell treated 8 hours before harvest. Arrow indicates a translocation.
2) Cell treated 4 hours before harvest. Arrows indicate chromatid breaks.

cells. Metaphase cells with translocation and chromatid breaks, and karyotype analyses made in control and treated samples are shown in Figs. 1–3. From these figures it is shown that the localization of chromatid breaks is distributed randomly. The configuration of a

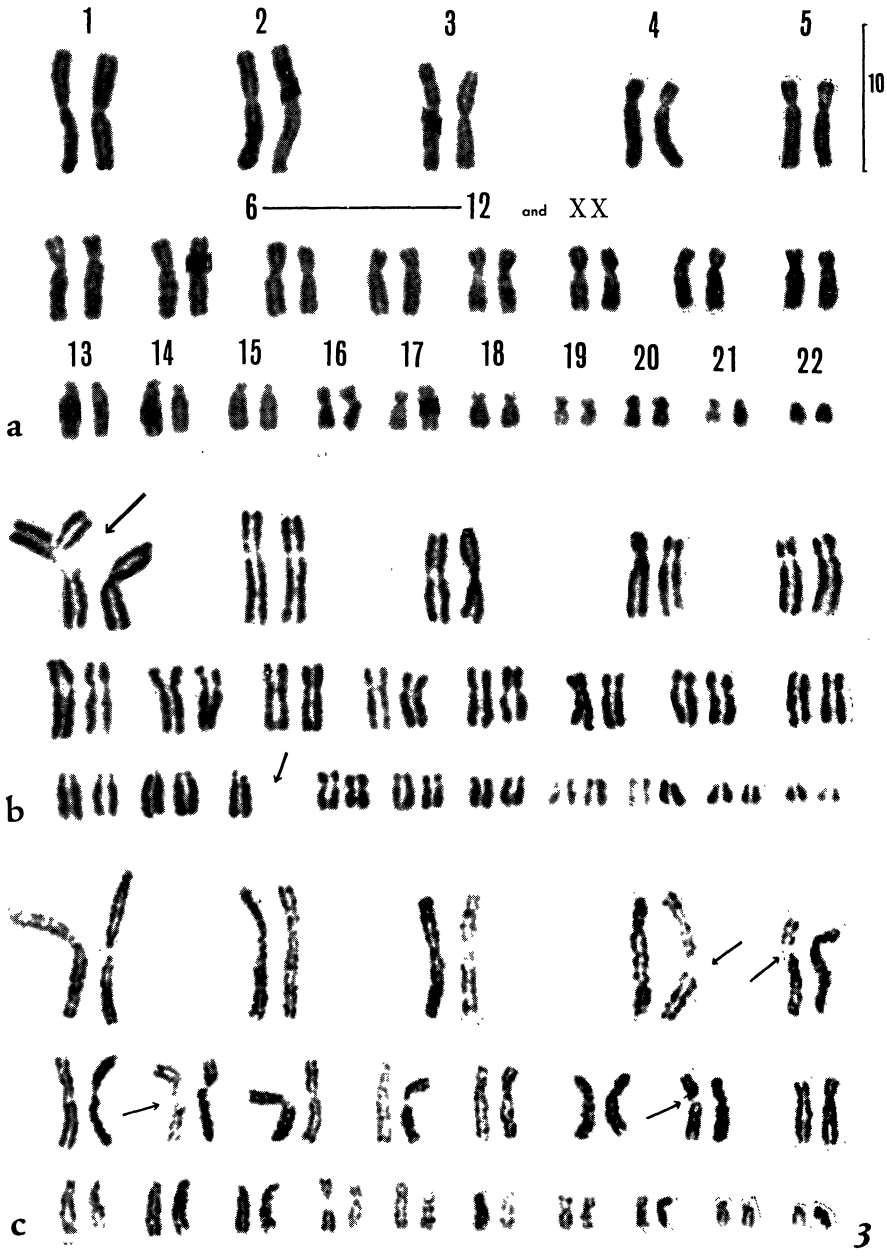

Fig. 3. The karyotype arrangement in control and treated cells.
a: Control cell, b: From the metaphase shown in Fig. 1, c: From the metaphase shown in Fig. 2. Arrows indicate a translocation and chromatid breaks.

translocation which occurred between pairs No. 1 and No. 15 is shown in Fig. 3b. The distribution of chromosome number in the control and the treated cells is examined (Table I). Hypodiploid cells were observed only in the treated cells. Frequencies of abnormal cells which occurred by treatment with CdS are presented in Table II. In untreated control cells cultivated for 3 days, no chromosome aberration was noted. On the other hand, in the treated cells, higher occurrence of chromatid breaks (34%), isochromatid breaks (4%) and dicentric chromosomes (14%) was observed in 4 hours treatment. In 8 hours treatment, chromatid breaks somewhat decreased to 14%, while isochromatid breaks increased in frequencies (28%). In addition, translocation (12%) and dicentric chromosomes (6%) were found in this treatment. Most of the dicentric chromosomes were observed in the chromosome pair No. 4. Since chromatid aberrations were found so frequently in cultured cells treated 4 and 8 hours before harvest, these aberrations should have occurred in the late S and the G_2-periods. Based on the above investigations it seems highly possible that cadmium sulfide has some mutagenic action on the genetic material as seen in some other chemicals. However, further experimental insight into the role of irrepairable damage to genetic material and the related genetic consequence is obviously needed. Detailed experiments are in progress with various concentrations and durations of treatment.

Table I. The distribution of chromosome numbers in leucocytes exposed to CdS

Duration of treatment (hours)	Chromosome number						Total No. of cells observed
	44	44	45	46	47	47	
0 (control)	0	0	0	50	0	0	50
4	0	1	4	45	0	0	50
8	0	2	5	43	0	0	50

Table II. Chromosome aberrations and their frequencies in human leucocytes after treatment with CdS

Duration of treatment (hours)	Total No. of cells observed	No. of cells with chromatid breaks (%)	No. of cells with isochromatid breaks (%)	No. of cells with translocation (%)	No. of cells with dicentric chromosomes (%)
0 (control)	50	0	0	0	0
4	50	17 (34)	2 (4)	0	7 (14)
8	50	7 (14)	14 (28)	6 (12)	3 (6)

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