enzyme were due to direct action of the hormone on the enzyme or not.

Results and discussion. The activity of LDH is lower in the pituitary of 38-week-old rat than in the 7-week, and increases in 78-week-old rats (figure). Such type of increase in the LDH activity has also been found in the kidney, liver and lung of male mouse[13,14]. Castration decreases the enzyme activity of pituitary at all ages, thereby indicating that androgens may be one of the factors that regulate the enzyme in this gland. Testosterone increases the enzyme activity in the pituitary of castrated rats of all 3 ages. Our studies on time-dependent response of LDH of pituitary to the hormone reveals that maximum response is 4 h after administration of hormone. The hormone treatment for 8, 16 and 24 h has no significant effect as compared to that of 4 h. Studies of Stifel et al.[15] on dose and time response of rat jejunal glycolytic enzymes, phosphofructokinase, pyruvate kinase and fruxtose diphosphatase, to oral sex hormones indicate that changes in the enzyme activities occur from 4 h after following intubation with hormone, and reach a maximum at 16 h. In our studies, however, the maximum response is seen 4 h after administration of hormone. The discrepancy between our and Stifel et al.[15] findings may be due to difference in the mode of administration of hormone. Also, pituitary may be one of the sensitive tissues to sex hormones. The maximum effects on the activity of LDH are observed with 50 and 100 µg of testosterone, and thereafter no significant dose-dependent effect is observed. The finding is in agreement with that of Stifel et al.[15], who have observed that, in rat jejunam, the activities of phosphofructokinase, pyruvate kinase and fructose diphosphatase show significant adaptive changes with various doses of testosterone ranging from 1 to 100 µg. The maximum effect was observed with 50 µg of testosterone. As far as age is concerned, the magnitude of increase in enzyme activity is higher in 38- and 7-week-old rats. However, the 100 µg testosterone causes about 2fold increase in the enzyme activity than that of 50 µg in castrated 38-week-old rats. But in 7-weeks-old rats, both doses of the hormone have almost the same effect. This shows that the response of the enzyme to hormone increases in 38-week-old rats. Such type of higher induction of enzyme has also been reported for soluble alanine aminotransferase of the liver of rat[16]. However, the magnitude of response of LDH to hormone decreases considerably in 78-week-old rats. Such an age-dependent impairment in the magnitude of induction of cytoplasmic malate dehydrogenase[17], ornithine aminotransferase and glucose 6-phosphatase of the liver[8], thymidine kinase and deoxythymidylate synthetase of salivary gland[18] and pyruvate kinase of cerebral hemisphere[19] has also been reported in the rat. Our in vitro studies on the effects of various doses of testosterone on LDH do not reveal any significant changes in the activity of enzyme of normal and castrated rats. It is, therefore, not necessary to give data. Thus it is seen that the response of this enzyme in this gland is dose and age-dependent.

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Stable and transmissible dicentric chromosome with terminal centromeres in ascites cells of mouse sarcoma 180[1]

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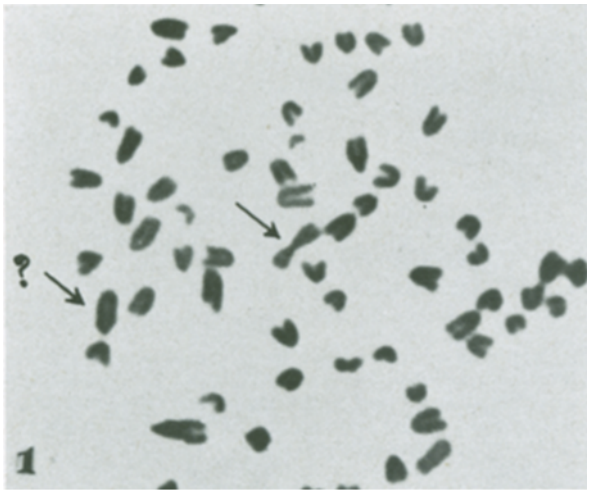
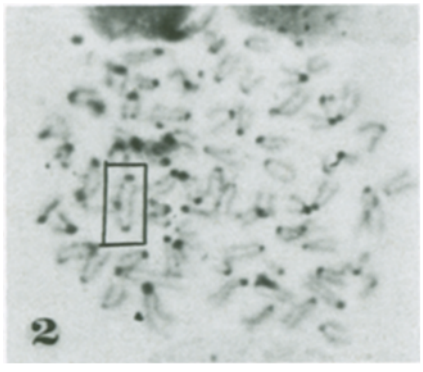
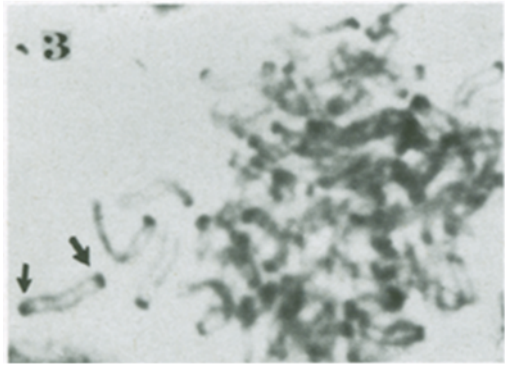
Summary. The occurrence of a stable and transmissible dicentric chromosome with 2 terminal centromeres has been reported in the ascites form of mouse sarcoma 180 cells which is chromosomally hypotetraploid. The number of such dicentrics is 2 in all endoreduplicated cells. The probable mode of anaphase separation of the dicentric has been discussed.

A great deal of verbiage has been spent on the problem of the stability of dicentric chromosomes in the karyotypes of plants and animals. It has been suggested by most of the pioneer investigators that dicentric chromosomes are usually unstable, since theoretically there are 2 different centromeres on the same chromatid that migrate to opposite poles during cell division instituting a bridge-breakage-fusion cycle[2]. This suggestion is quite consistent with the observed mode and behaviour of artificially induced dicentric chromosomes because in all known cases such dicentrics were found unstable. On the contrary, evidences are now accumulating on the spontaneous occurrence and successful transmission of dicentric chromosomes in natural populations as well as in different tissue culture lines[3-9]. These findings are now casting doubt on the concept of dicentric chromosome instability in natural populations. The present communication is a report on the occurrence of a stable dicentric chromosome with 2 distinct terminal C-positive heterochromatic zones in the ascites cells of mouse sarcoma 180 (MS-180).

Chromosomes from the ascitic fluid of MS-180 were prepared after 96 h of transplantation by following colchicine-saline citrate acetic-alcohol-flame drying technique[10]. C-banding was performed by slight modification[11] of the







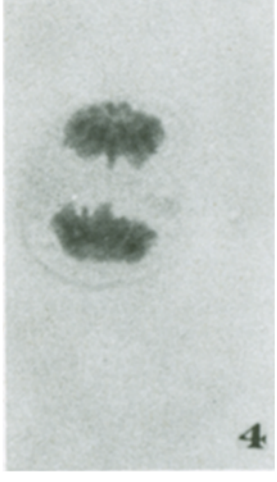


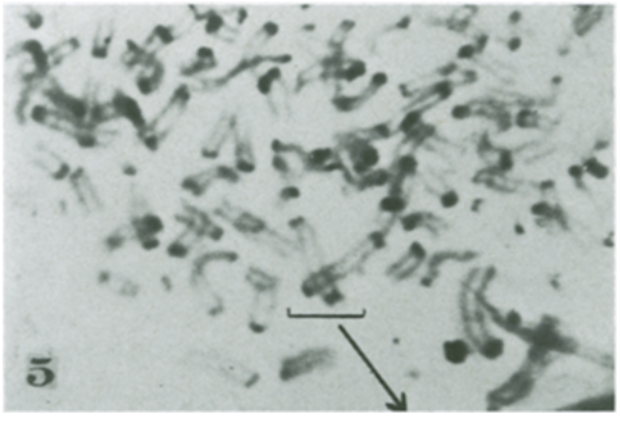
Fig. 1. Conventional giemsa-stained metaphase from MS-180 cell showing a bi-armed marker (arrowed) and a probable dicentric (?)chromosome. Fig. 2. C-banded metaphase from MS-180 showing a dicentric (boxed) with 2 terminal C-positive zones. Fig. 3. C-banded metaphase showing isolated peripheral disposition of the dicentric chromosome. Fig. 4. PMG-stained late anaphase from MS-180 showing probable dicentric chromosomes with protruded orientation.

technique suggested by Sumner[12]. Standard PMG technique has been employed for anaphase study.

The modal chromosome number of this hypotetraploid tumour is 75 with 1 bi-armed marker chromosome and a variable number of 'double minutes' (usually 1-4)[9] (figure 1). Conventional giemsa staining at a pH of 7.2 revealed no other karyological peculiarities. But critical C-banding analysis clearly revealed that in addition to the bi-armed marker, the cell-line also contains a dicentric chromosome with 2 distinct terminal C-positive zones (figures 2 and 3).

The existence of this unusual dicentric chromosome has been documented unmistakably in about 94% metaphases examined from different individuals after several successive in vivo passages of the tumour, which is indicative of the fact that this dicentric chromosome is a stable and transmissible member in the karyotype of MS-180. It is, however, interesting that cells that have undergone endoreduplication (a common phenomenon in this cell-line) contain 2 instead of 1 identical dicentric chromosomes (figures 5 and 7). This is in agreement with the fact that this particular chromosome is also able to undergo normal duplication prior to the cell division. Another remarkable behaviour noted in the present study is that in most cells this dicentric chromosome occupies an isolated peripheral position in C-metaphases (figure 3). In spontaneous metaphases, on the other hand, the dicentric element showed a peculiar protruded orientation when viewed from the polar end.

The occurrence of dicentric chromosomes has been reported in many plant and animal materials by following treatment with the different mutagens but instability in subsequent cell divisions leads to their quick elimination



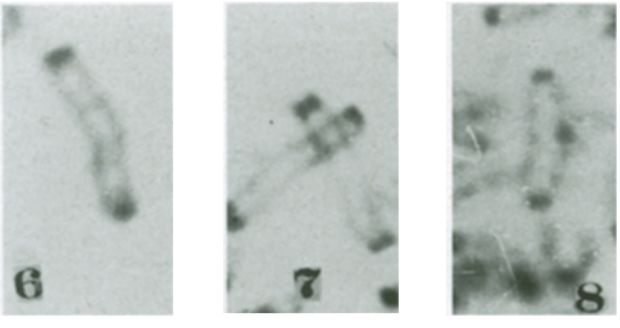


Fig. 5. Part of the C-banded metaphase of an endo-reduplicated MS-180 cell with 2 dicentric chromosomes disposed in a crosslike manner (enlarged in figure 7). Figures 6 and 8. Enlarged views of the dicentric chromosomes exibiting 2 almost equal C-positive zones and uniformity in length.

within a few cell generations. In certain rare instances, they may be retained even after many divisions where a breakage-fusion-bridge cycle is in operation[13,14], or in those cases in which 1 of the 2 centromeres assumed dominant centromeric activity and the other remained suppressed during anaphase movement, as reported by Sears and Camara in *Triticum*[3] and, more recently by Niebuhr in the human[5]. However, in our material it is difficult at present to suggest accurately what is the exact mode of separation and the mechanism of migration of the dicentric chromosome during anaphase stage of cell division. It is well known that the mouse cell material is not at all a suitable tool for anaphase study. Moreover, due to hypotetraploid condition, it becomes more difficult to obtain a clear view of individual chromosomes during anaphase separation. Since no variation in the lenght of the dicentric chromosome has been noticed even after successive in vivo passages of the tumour (figures 6–8), it may be assumed that McClintock's breakage-fusion-bridge cycle is not in action in this particular cell-line. This idea is further strenghtened by the fact that no dicentric bridge has been encountered in anaphase stages studied so far.

In their material, both Sears and Camara[3] and Niebuhr[5] have noted an unequal size of centromeres and assumed that during division 1 of the 2 centromeres remained attached with the spindle fibre and the other remained inactive. But in contrast to this finding in our material we have noticed 2 almost equal sized centromeres (figures 6–8). However, in PMG stained late anaphases of MS-180 the existence of 2 protruded chromosomal elements on either side of the separating cells led us to suggest that probably in this case also 1 of the 2 centromeres have taken dominant activity and the other remained suppressed (figure 4).

Again an isolated peripheral placement of the dicentric in C-metaphases and a peculiar protruded orientation in spontaneous metaphases have produced another confusing situation. Several workers have reported the occurrence of nuclear projections in the interphase nuclei of various tumours in association with long chromosome markers[15,16]. However, in MS-180 cells such protrusions are visible only in well-flattened spontaneous metaphases and in late anaphases (figure 4) in relation to the dicentric marker. In interphase stage, on the other hand, no such nuclear projection has been recorded. The occurrence of the unusual dicentric element in most of the C-metaphases, and the detection of several spontaneous metaphases with protruded chromosomes corresponding to the dicentrics, is in support of the view that abnormal dicentric markers encounter an apparently normal division during mitotic process; but their behaviour during anaphase and in other stages of cell division still requires further elucidation.

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Inbreeding effect: Embryonic development and fecundity of *Drosophila melanogaster* offspring

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Summary. Inbreeding depression observed on fecundity of adult *Drosophila* depends on the effect observed during development of the eggs laid by their parents. This depression does not then depend on the homozygosity per se of the adult genome. It is mainly due to the deleterious effect observed primarily during embryogenesis.

Inbreeding depression is believed to result from expression of lethal recessive genes ordinarily concealed in the genome. Because of a large number of loci at which lethality may occur[2–5], development is perturbed at different stages up to adulthood. However, by studying egg hatchability and egg-to-adult survival, one of us has shown that mortality during embryonic development of a batch of inbred eggs leads to a correlative depression at the larvo-pupal stage[6]. Some embryos do, however, develop normally from fertilisation to adulthood even when inbreeding depression occurs during embryogenesis. We can therefore ask if lethality during development may be associated with a correlative effect in the resulting offspring. We now compare fecundity among inbred offspring from different sib couples. We show that inbreeding depression during development in batches of inbred eggs leads to adults with reduced egg production.

Flies from a wild stock of *Drosophila melanogaster* were reared in an axenic maize-dried yeast-agar medium[7] at 25 °C. P_0 couples, randomly mated, were set up in small boxes with medium to reproduce. The F_1 siblings descended from each P_0 female were crossed. The ensemble of F_1 sib couples thus obtained from a single P_0 couple is called a family. An F_1 couple was considered 'sensitive' to inbreeding when some of its eggs showed blocking during development. These eggs generally exhibited normal embryogenesis but the larvae failed to hatch. Only 1 F_1 family which produced both sensitive and insensitive couples was observed intensively. 3 F_1 sib couples from this family and their F_2 offspring were studied. The 1st F_1 couple (a, table) laid eggs some of whose embryos died during embryonic and larvo-pupal stages. Embryos which developed successfully gave F_2 flies whose egg production was recorded. The 2nd F_1 couple (b, table) laid eggs that developed normally