Leigh, B. University of Leiden, The Netherlands. X-ray induced reversion of isochromosomes in mature sperm.

Regulation during very early embryogenesis is one of the processes which has been assumed to permit operation leading to the recovery of induced autosomal isochromosomes, i.e. the loss of one chromosome arm and a doubling of the other arm relative to the other chromosomes from the male gametic nucleus. One way of further testing this hypothesis is to create a different situation in which it is necessary for an analogous type of regulation to occur in order to obtain viable progeny.

Autosomal isochromosomes disjoin randomly during meiosis in spermatocytes. When males carrying such chromosomes are mated to females carrying regular metacentric chromosomes there are no viable progeny. 25% of the zygotes are found by the fusion of haploid female gametes with disomic male gametes. By irradiation of the disomic male gametes, before fertilization, it shoud be possible to induce reversions of the isochromosomes. These reconstituted metacentrics will be recovered in viable progeny only when there is regulation during early embryogenesis.

One-day old C(2L)RM, b;C(2R)RM, cn males were given an exposure of 1500 R and then individually mated for 2 days to 6 virgin females of the genetic constitution Cy dp^2/Bl h^2. All surviving progeny were tested. About 20% were either sterile or died before they could be mated. The remainder could be divided into three approximately equal classes; homozygous lethal, homozygotes showing phenotypic anomalies, and apparently normal. The phenotypic anomalies were of two types; either a lightening of the vermilion eye color or an elbow (el) -like modification of the wings.

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Leigh, B. University of Leiden, The Netherlands. Induction of attached-X chromosomes in spermatozoa, by X-irradiation.

During discussions with F.H. Sobels, I.I. Oster and R. Falk it became clear that because autosomal isochromosomes can be induced in post-meiotic male germ cells it should, by analogy, be possible to induce attached-X chromosomes in these same germ cell stages. Neuhaus (Nature 1936, 137:996-997) reported the recovery of attached-X chromosomes from males carrying either an $X{\cdot}Y^S$ or $X{\cdot}Y^L$ chromosome but not from males carrying a single X chromosome. However, from this early paper it is not possible to determine either the germ cell stage which was treated or the radiation exposure.

One-day old males, either X/Y (ORK) or $X{\cdot}Y^S/Y^{LC}$ were given an exposure of 1500 R and then individually mated for 3 days to 6 virgin females of the genetic constitution C(1)RM, y w f/Y. All wild type female progeny were tested. These were found either to result from a breakdown of the maternal attached-X chromosome or to carry newly induced attached-X chromosomes. The rates of attached-X induction were 0/14,500 in X/Y males and 11/5,000 in $X{\cdot}Y^S/Y^{LC}$ males. No spontaneously attached-X chromosomes were recovered in simultaneous control experiments.

When these results are considered in relation to the models of isochromosome induction and recovery discussed by Leigh and Sobels (Mutation Res. 1970, 10:475-487) two conclusions can be drawn. Firstly, it is unlikely that centromere splitting is an operative model; otherwise attached X chromosomes should also have been recovered from the irradiated ORK males. Secondly, regulation must be operative during early embryogenesis in order to permit the recovery of the attached-X's which were found.

The rate of attached-X chromosome induction is low compared to the rates of recessive lethals or translocations. However, it is high when compared to the estimated rates of autosomal isochromosome induction. This probably reflects the greater capacity of the X chromosome to modification without causing lethality. The rates of attached-X induction may be high enough to determine the kinetics and this to find out whether one-hit or two-hit processes are involved.

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