JEP> Vol.1 No.3, September 2010

OPEN ACCESS

Exposure to Oil during Meiosis Results in Alterations in Meiotic Chromosomes that are Similar to Age-Related Changes in the Nematode Caenorhabditis elegans

PDF (Size:1766KB) PP. 226-230 DOI: 10.4236/jep.2010.13027

Author(s)

Paul Goldstein

ABSTRACT

Exposure of young C. elegans nematodes to three different concentrations of oil resulted in changes in the meiotic chromosomes, nucleus, nucleolus, and nuclear envelope associations. Such alterations decreased the viability and fertility of this organism which was used as a biological model. The morphological changes in the "young" group were similar to nematodes that were senescent and post-reproductive. Comparison of meiotic chromosomes at the pachytene stage of meiosis from young, old, and oil-exposed wild-type hermaphrodites were made following three-dimensional electron microscopy reconstruction of serial ultrathin sections. Age-related and oil-exposure related changes included: 1) Induced condensation of chromatin with increased variance in length of chromosomes; 2) Changes in nuclear and nucleolar volume; 3) Increased density of the nucleoplasm; and 4) Absence of Disjunction Regulator Regions, resulting in the loss of control of the segregation of the X-chromosome into gametes during meiosis. Abnormal clustering of the telomeric ends of the chromosomes was present on the nuclear envelope affecting the segregation of the chromosomes during meiosis.

KEYWORDS

Oil, Age, Chromosome, Synaptonemal Complex

Cite this paper

P. Goldstein, "Exposure to Oil during Meiosis Results in Alterations in Meiotic Chromosomes that are Similar to Age-Related Changes in the Nematode Caenorhabditis elegans," *Journal of Environmental Protection*, Vol. 1 No. 3, 2010, pp. 226-230. doi: 10.4236/jep.2010.13027.

References

[1] D. Kram and E. L. Schneider, "Parental-Age Effects: Increased Frequencies of Genetically Abnormal Offspring," In: E. L. Schneider, Ed., The Genetics of Aging, Plenum Press, NY, 1978, pp. 225-260.

[2] J. Meyne and L. Deaven, "In vivo Cytogenetic Effects of Oil Shale Retort Process Waters," Toxicology, Vol. 24, No. 3-4, 1982, pp. 223-229.

[3] J. Hodgkin, R. Horvitz and S. Brenner, "Nondisjunction Mutants of the Nematode Caenorhabditis elegans," Genetics, Vol. 91, No. 1, 1979, pp. 67-94.

[4] J. Hodgkin, "More Sex Determination Mutants of Caen- orhabditis elegans," Genetics, Vol. 96, No. 3, 1980, pp. 649-664.

[5] P. Goldstein, "Aneuploidy in the Normal Life Cycle of the Nematode Caenorhabditis elegans," In: B. Vig and A. Sandberg, Eds., Aneuploidy, Part A: Incidence and Etiology, Alan R. Liss, New York, 1987, pp. 189-204.

[6] P. Goldstein, "The Synaptonemal Complexes of Caenorhabditis elegans: Pachytene Karyotype Analysis of the Dp1 Mutant and Disjunction Regulator Regions," Chromosoma, Vol. 93, No. 2, 1985, pp.177-182.

[7] D. Von Wettstein, S. W. Rasmussen and P. B. Holm, "The Synaptonemal Complex in Genetic

Segregation," Annual Reviews of Genetics, Vol. 18, 1984, pp. 331-413.

[8] P. B. Moens, "The Structure and Function of the Synaptonemal Complex in Lilium longiflorum Sporocytes," Chromosoma, Vol. 28, No. 1, 1968, pp. 1-25.

[9] M. Maguire, "Evidence for Separate Genetic Control of Crossing over and Chiasma Maintenance in Maize," Chromosoma, Vol. 65, No. 2, 1982, pp. 173-178.

[10] S. W. Rasmussen and P. B. Holm, "Mechanism of Meiosis," Hereditas, Vol. 93, No. 2, 1980, pp. 187-216.

[11] P. Goldstein and D. Slaton, "The Synaptonemal Complexes of Caenorhabditis elegans: Comparison of Wild-Type and Mutant Strains and Pachytene Karyotype Analysis of Wild-Type," Chromosoma, Vol. 84, No. 4, 1982, pp. 585-590.

[12] P. Goldstein, "The Synaptonemal Complexes of Caenorhabditis elegans: Pachytene karyotype Analysis of Male and Hermaphrodite Wild-Type and Him Mutants," Chromosoma, Vol. 86, No. 4, 1982, pp. 577-593.

[13] J. Gerton and R. Hawley, "Homologous Chromosome Interactions in Meiosis: Diversity amidst Conversation," Nature Review Genetics, Vol. 6, No. 6, 2005, pp. 477- 487.

[14] D. Zickler and N. Kleckner, "Meiotic Chromosomes: Integrating Structure and Function," Annual Reviews of Genetics, Vol. 33, 1999, pp. 603-754.