MEDWIN PUBLISHERS
Committed to create value for Researchers

Advances in Clinical Toxicology

Polytene Chromosomes as a Genotoxicology Tool

Ayla Karataş*

Kocaeli University Education Faculty Campus of Umuttepe Kocaeli,Turkey

Editorial

Volume 2 Issue 1

Received Date: September 27, 2017

Published Date: October 02, 2017

***Corresponding author:** Ayla Karatas, Associate professor, Kocaeli University Education Faculty Campus of Umuttepe Kocaeli, Turkey, Tel: 00905323339875; E-mail: karatasayla@gmail.com

Editorial

It is not possible to visualize the interphase chromosomes with light microscopy; however, polytene chromosomes are giant interphase chromosomes visible under light microscopy. Therefore, polytene chromosomes of *Drosophila melanogaster* are unique materials for the observation and analysis of the genome and genetic organization of chromosomes in the interphase stage. Polytene chromosomes form through the sequential replication of the chromosomes of the diploid nucleus division of the cytoplasm following the replication. This way, a chromosome 70 to 110 time thicker than a typical metaphase chromosome and observable with light microscopy, appears. This interesting polyteny occurs within the cellular cycle, during the mid-phases of *Drosophila melanogaster's* embryogenesis under ecdysone, which is particularly important for the development of larva. Investigation of every aspect of polytene chromosomes is very useful for the analysis of chromosomal organization and genome as a whole [1,2].

The most detailed maps of the polytene chromosomes in salivary glands of *Drosophila melanogaster* were created by Bridges using light microscopy in 1930s and 1940s [3]. The stiffly packed and dense dark areas are called bands, and lighter and less dense areas are called interbands. Localization of RNA polymerase II and related transcription factors on interbands shows that active genes tend to locate on these band areas [4]. Furthermore, areas in the interbands that are swelled more densely and observed as puffed areas are called puffs. Typical feature of puff areas is that they are rather active gene areas with RNA synthesis in higher rates as compared to the other areas of the interphase chromosomes. So, model, sequence and timing of puffing in the polytene chromosomes can be considered as indicators of gene activity in the interphase nucleus. This way, it is possible to study the interphase nucleus with cytogenetic methods [5,6]. Changes in the puffing activity observed on polytene chromosomes constitute a series of events. This series of events occurring under the control of a set of gene complex provides opportunity to understand the regulation of development [7,8]. Changing environmental conditions cause occurrence of differences in the puffing model [6-9]. Polytene chromosomes of *Drosophila* larvae and puffing model constitute a useful model for the understanding of the effects of environmental factors on gene activity through cytologic observations. Changes in puffing models and in addition chromosomal abnormalities have been found in band regions as a result of administration of various toxic substances to *Drosophila* [1-12]. It can be said under the light of the data obtained that polytene chromosomes are good materials as a toxicology tool.

Puffs on the polytene chromosomes known as ecdysone puffs are located on 2B, 8EF, 10EF, 12DE, 13E, 21C, 22C, 23E, 27C, 28A, 29F, 42A, 43E, 44A, 46A, 46F, 47A, 47BC, 48B, 49E, 50CD, 50F, 62E, 63F, 67B, 70C, 70E, 72D, 73B, 74EF, 75B, 75D, 76A, 76D, 78C, 86E, 87F, 89B, 98F, 99Band 100E band areas [13]. Here are numerous studies on genes of such puff areas However, the understanding of localizations of genes on polytene chromosomes is not complete yet [14,15]. Therefore, elucidation of positions of genes on polytene chromosomes will ensure both a better understanding of interphase chromosomes and organization and operation of genes. We can say that, although investigators have been focused on polytene chromosomes since for almost 90 years, there is still must effort to be exerted on polytene chromosomes.

References

1. Karataş A, Bahçeci Z, Başpınar E (2012) Diazinonun Drosophilamelanogaster' in Politen Kromozomlarında Puflaşma Aktivitesi Üzerine Etkisi. Ekoloji Dergisi 21(85): 98-106.

2. Zhimulev IF, Belyaeva ES, Vatolina TY, Demakov SA (2011) Banding patterns in Drosophila melanogaster polytene chromosomes correlate with DNA-binding protein occupancy. Prospects & Overviews 34(6): 498-508.

3. Semeshin VF, Belyaeva ES, Zhimulev IF (2001) Electronmicroscope mapping of the pericentric and intercalary heterochromatic regions of the polytene chromosomes of the mutant Suppressor of underreplication in Drosophila melanogaster. Chromosoma 110(7): 487-500.

4. Johansen KM, Cai W, Deng H, Bao X, Zhang W, Girton J, Johansen J (2009) Polytene chromosome squash methods for studying transcription and epigenetic chromatin modification in Drosophila using antibodies. Methods 48(4): 387-397.

5. Schwartz YB, Ioudinkova ES, Demakov SA, Razin SV, Zhimulev IF (1999) Interbands of Drosophila melanogaster polytene chromosomes contain matrix association regions. J Cell Biochem 72(3): 368-372.

6. Zhimulev IF, Belyaeva E, SemeshiN VF, Koryakov DE, Demakov SA, et al. (2004) Polytene chromosomes: 70 years of genetic research. Int Rev Cytol 241: 203-275.

7. Dworniczak B, Seidel R, Pongs O (1983) Puffing activities and binding of ecdysteroid to polytene chromosomes of Drosophila melanogaster. The EMBO Journal 2(8): 1323-1330.

8. Semeshin VF, Demakov SA, Shloma VV, Vatolina TY, Gorchakov AA, et al. (2008) Interbands behave as decompacted autonomous units in Drosophila melanogaster polytene chromosomes. Genetica 132(3): 267-279.

9. Zhimulev IF (1999) Genetic organization of polytene chromosomes. Adv Genet 39: 1-589.

10. Karataş A, Bahçeci Z (2009) CypermethrininDrosophila melanogaster' in Üçüncü İnstar Larvalarının Tükrük Bezi Politen Kromozomları Üzerine Etkisi. AKÜ Fen Bilimleri Dergisi 01: 97-106.

11. Karataş A, Bahçeci Z (2011) Sodyum arsenit ve krom (III) klorürün Drosophila melanogaster' in politen kromozomlarına etkisi. Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi 27(4): 317-325.

12. Uysal H, Bahçeci Z (1996) Kurşun nitratın Drosophilamelanogaster' in üçüncü instar larvalarının tükrük bezi politen kromozomları üzerine etkileri. Tr J of Biology 20: 199-205.

13. Lam GT, Jiang C, Thummel CS (1997) Coordination of larval and prepupal gene expression by the DHR3 orphan receptor during Drosophila metamorfosis. Development 124(9): 1757-1769.

14. Andres AJ and Thummel CS (1995) The Drosophila 63F early puff contains E63-1, an ecdysone-inducible gene that encodes a novel Ca(2+)-binding protein. Development 121(8): 2667-2679.

15. Zimowska G and Paddy MR (2002) Structures and Dynamics of Drosophila Tpr inconsistent with a Static, Filamentous Structure. Exp Cell Res 276(2): 223-232.