

Structural and functional Significance of Polytene chromosomes

Giant chromosomes are of two types. Polytene chromosomes (Salivary gland chromosomes) and lampbrush chromosomes.

Polytene chromosomes - (Salivary gland chromosomes)

Normally chromosomes are not visible during interphase, but polytene chromosomes are exception. They were first described by Balbiani (1881) in the salivary glands of the midge chromosomes and are hence called Salivary gland chromosomes.

Structure of polytene chromosome - In the salivary glands of chromosomes of *Drosophila* DNA is concentrated in the bands, while the interbands have very little DNA. The presence of DNA in the interbands has been established by quantitative staining with fucojen stain, by fluorescent dyes and by tritium thymidine labelling. DNA is associated with protein (both histone and non histone) to form nucleoprotein fibres (100-500 Å).
 In prawn and Rae (1966) have shown that these fibres are comparable to the 100-500 nucleoprotein fibres that are found in typical interphasic nuclei. They have postulated that the fibres corresponds to unit chromatids (chromonemata). The polytene chromosomes are formed by 1000-4000 unit chromatids. Each unit chromatid consists of a single DNA molecule several centimeter long associated with proteins. The fibres are continuous from

end of the chromosomes to the other.

They are tightly folded in the bands and relatively extended in the interbands (Du Praw)

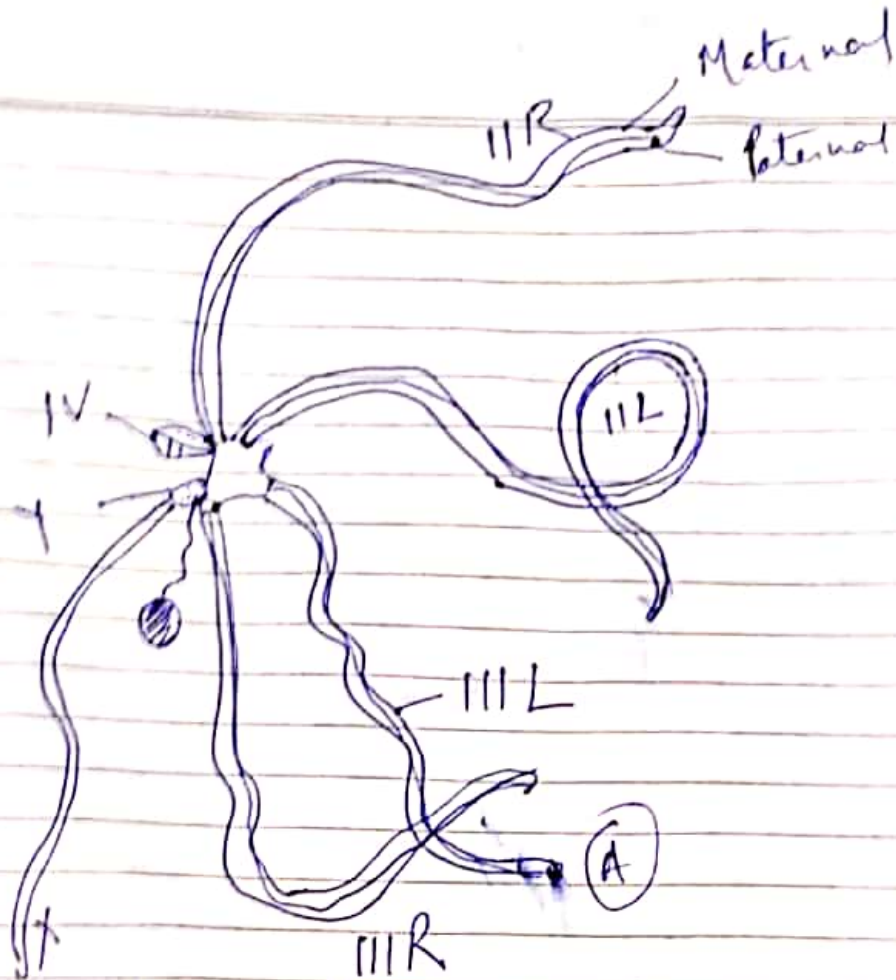
Chromosomal Puffs - The bands of polytene chromosomes becomes enlarged at certain times to form swellings which is called the chromosomal puffs or Balbiani rings. Puffs represents regions which are lightly coiled chromosomal fibres open out to form many loops. Thus puffing is due to unfolding or uncoiling of individual chromosomes in a band. The puffs are active genes and represent sites of RNA synthesis.

Functions of Polytene chromosomes -

① It has been found that chromosomal puffs are active in mRNA synthesis by the help of DNA template. It moves to the cytoplasm where it gets associated with the ribosomes and acts as a template for the synthesis of special proteins. The RNA of one puff varies from the mRNA made in another.

② The interbands are involved in the interaction with the active chromatin proteins, nucleosome remodelling, and origin recognition complexes.

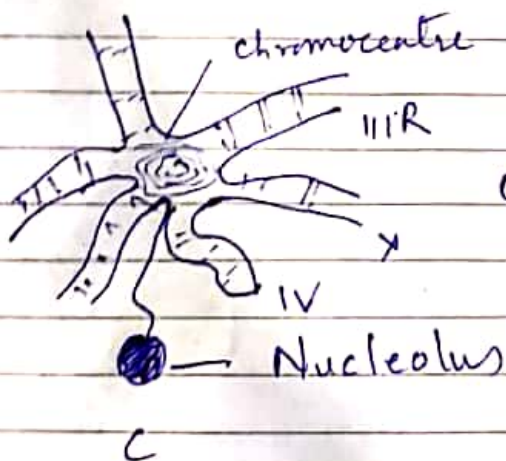
Their primary functions are to act as binding sites for RNA Pol II, to initiate replication and to start nucleosome remodelling of short fragments of DNA.



Salivary gland chromosome of *Drosophila*.
Chromomeres



Part of a chromosome showing (B)
bands of chromomeres.



central part of Polytene
chromosome.

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