

COURSE: M.SC. BOTANY PART-I PAPER – VII

TOPIC: LAMP BRUSH CHROMOSOME (CELL BIOLOGY)

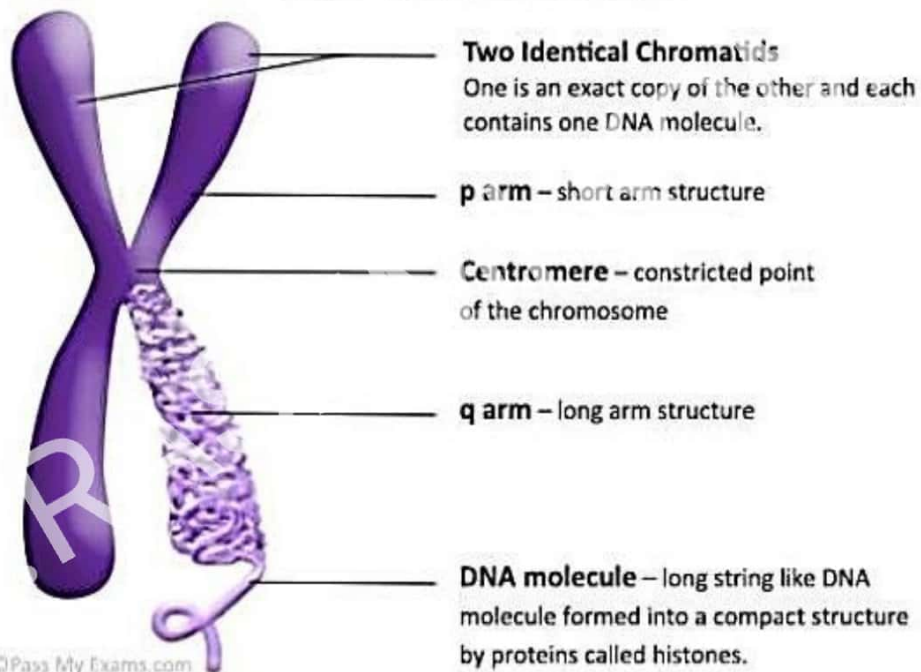
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Coordinated by Prof. (Dr.) Shyam Nandan Prasad

LAMP BRUSH CHROMOSOME (LBC)

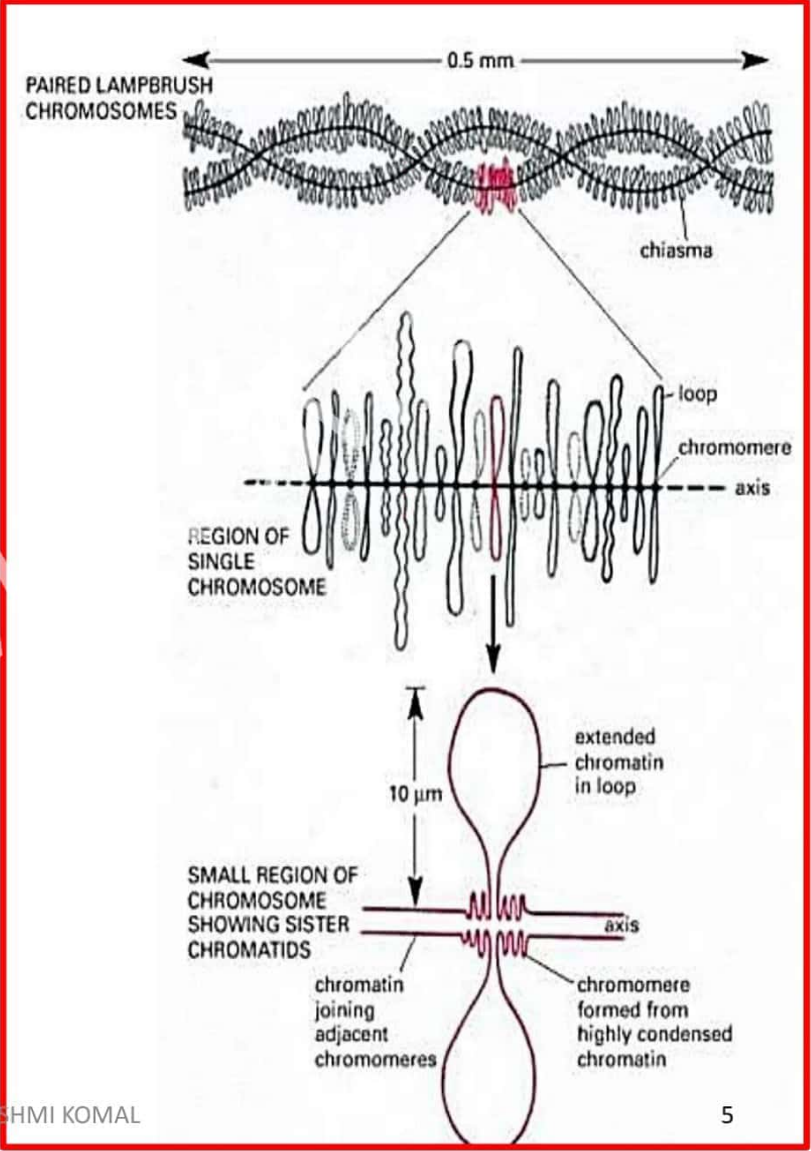
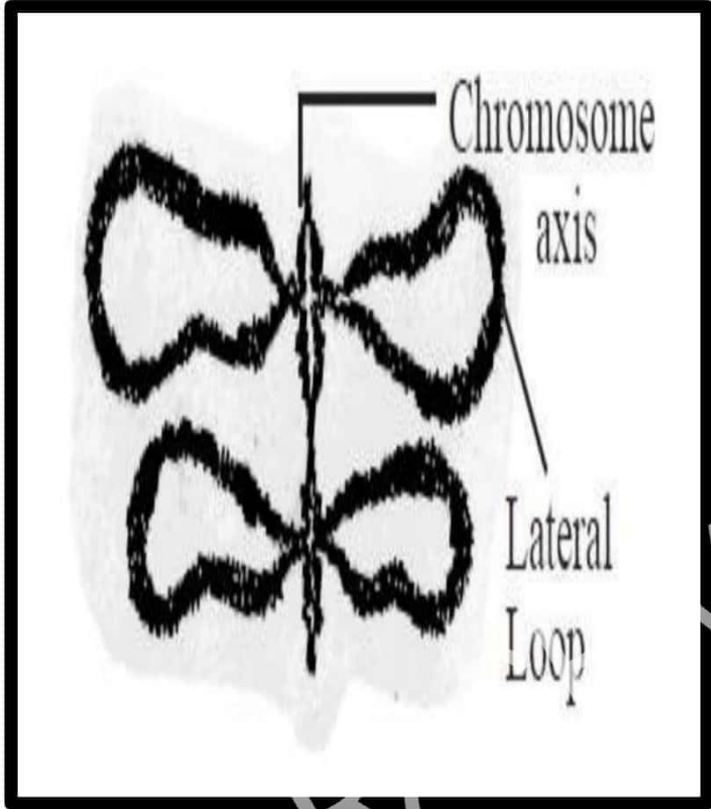
CHROMOSOME STRUCTURE

One Chromosome



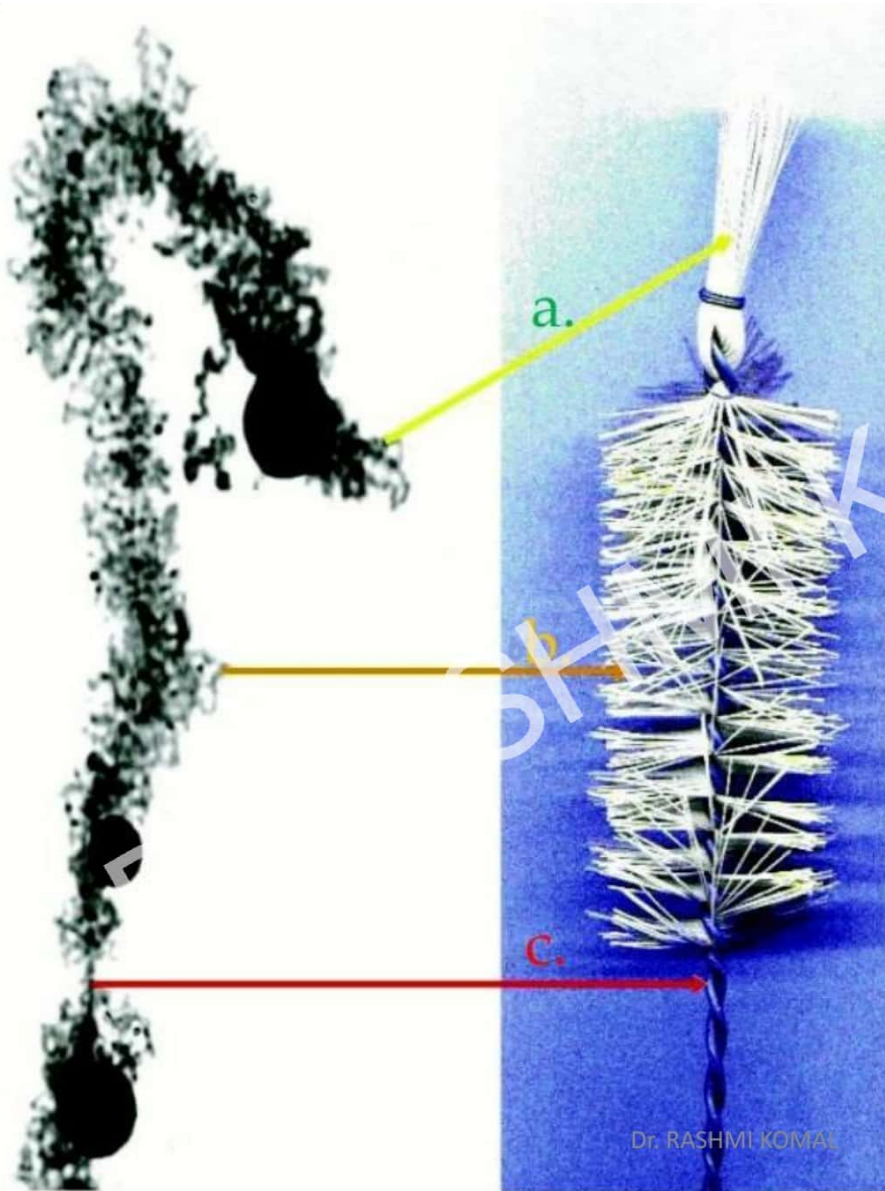
LAMP BRUSH CHROMOSOME

- Lamp Brush Chromosome (LBC) is a type of Special Chromosome, and is also known as **Giant Chromosome**.
- It occurs in oocytes of vertebrates as well as in some invertebrates.
- LBC have been reported in **plants** (Grun,1958), e.g. *Acetabularia* (the siphonal green algae).
- It is visible under light microscope.
- It is found in those cells which produce a lot of RNA, resulting in the increase in cytoplasmic and nuclear volume.
- The detailed structure has been studied during diplotene stage of meiotic division.
- During diplotene stage certain chr stretch out large loops of DNA causing the chr to resemble a lamp brush.



**DETAILED
STRUCTURE
OF LBC**

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A lampbrush chromosome and an original lampbrush :

- a. TELOMERIC LOOP
- b. SIDE LOOPS
- c. A CHROMATID WITHOUT LOOPS

- ❖ Longest chromosomes of all
- ❖ In oocytic nuclei of those animal which have large yolky eggs , the prophase of first meiotic division is extremely extended
- ❖ During this phase the oocytes grow and synthesise nutrition for the future embryo
- In oocytes the chromosomes become greatly enlarged and assume unusual configuration
- ❖ A large number of loops projects out from the chromatid axis , giving it a lampbrush appearance . Hence are called lampbrush chromosomes
- ❖ The lampbrush chromosomes are bivalents , each consisting of two chromatids
- ❖ These persist during the prolonged diplotene phase of first meiotic prophase
- ❖ First observed by Flemming (1882) and described by Ruckert (1892)
- ❖ They are seen in diplotene phase of insects , sharks , amphibians , reptiles and birds
- ❖ The lampbrush chromosomes in the oocytes of salamanders are the largest of all known chromosomes

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ULTRA STRUCTURE OF LBC

- ❖ A lampbrush chromosome consists of a central axis and a paired series of loop like lateral extensions
- ❖ The central axis consists of two bivalent homologous chromosomes , each with two chromatids , so altogether 4 chromatids are present
- ❖ They are held together through contact points or chiasmata
- ❖ The chromatids are drawn out into paired lateral loops ,so central axis extend to the lateral loops as loop axis
- ❖ Lateral loops contain bundles of sub-microscopic fibrils
- ❖ Both the central axis and the loop axis are formed of deoxyribonucleoprotein

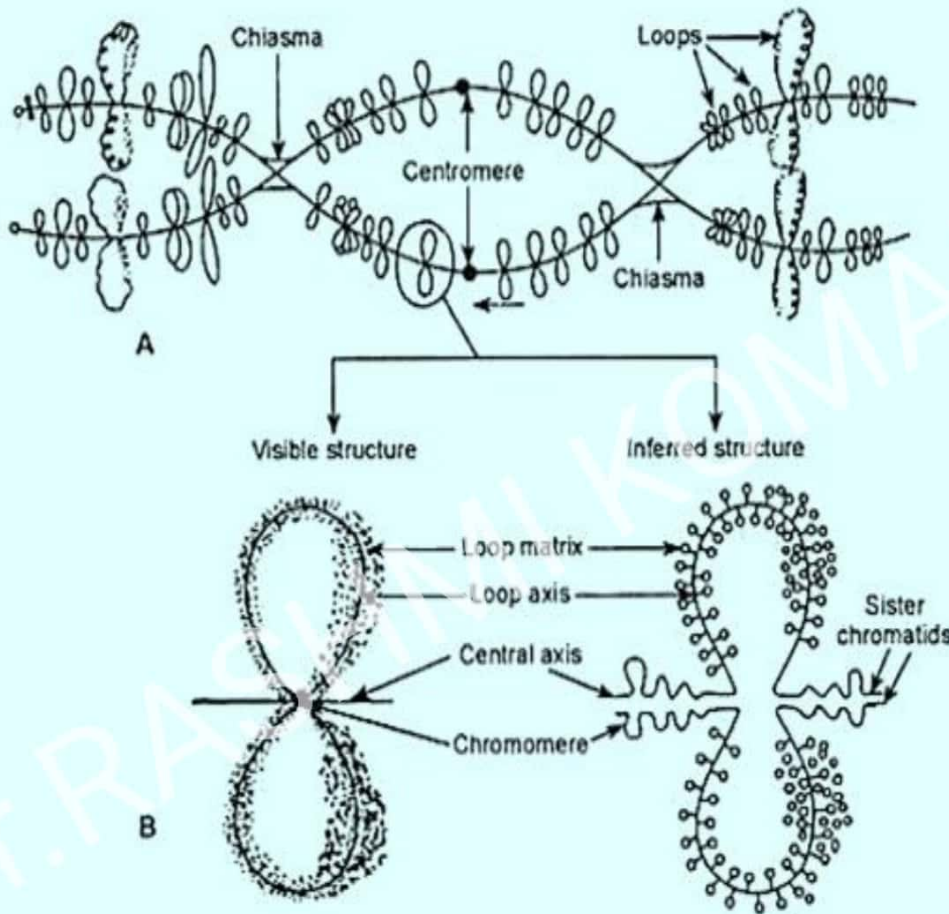
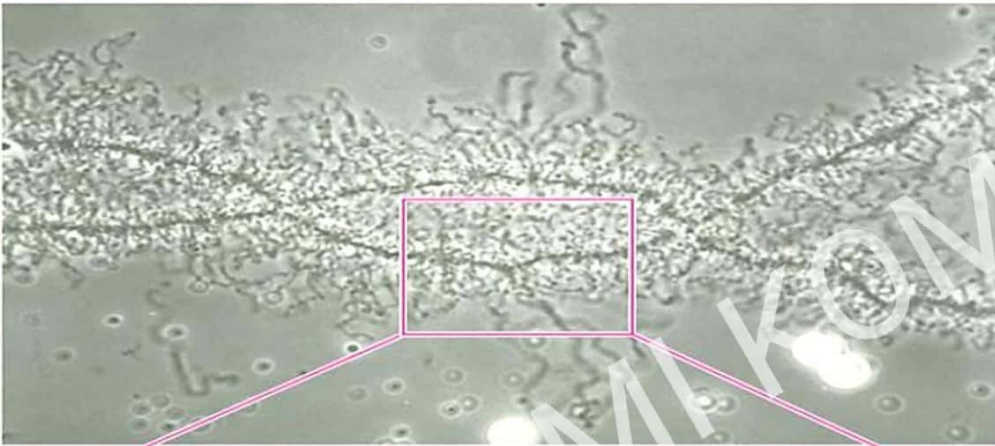


Fig. 7.13. Diagram of a lampbrush bivalent. A. Two chiasmata and several side loops on both the homologues. B. Detailed structure of a pair of loops. (Based on Lewis and John 1963).

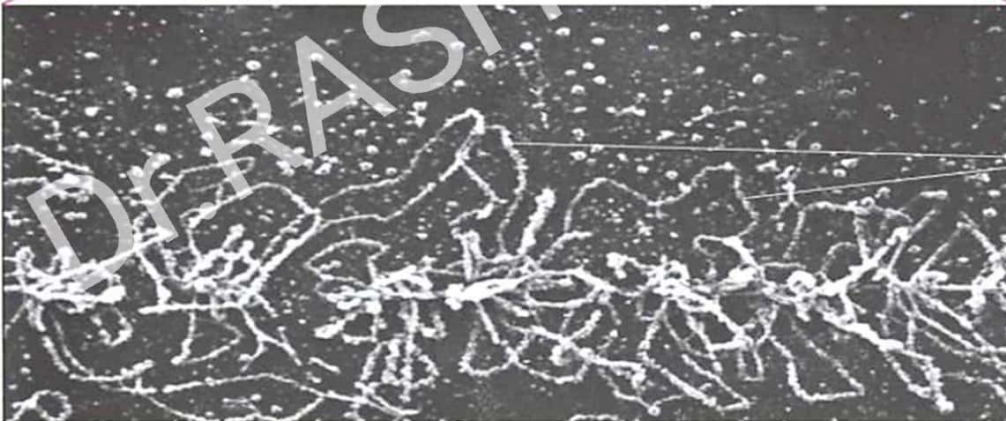
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- ❖ The loop axis may be coated with a matrix of RNA and proteins
- ❖ Lateral loops contain a fully extended DNA duplex, they are believed to be formed by uncoiling of sister chromatids, thus making their DNA available for transcription
- ❖ Lateral loops are the active centres for RNA synthesis
- ❖ Each loop may contain one or more transcription unit or transcripts
- ❖ Most of the newly synthesized RNA molecules associate with proteins and form a ribonucleoprotein (RNP) matrix
- ❖ m RNA is also associated with the development of zygote.
- ❖ The chromosomal axis may contain paired series of granular chromomeres, from where loop axes extend

(a)

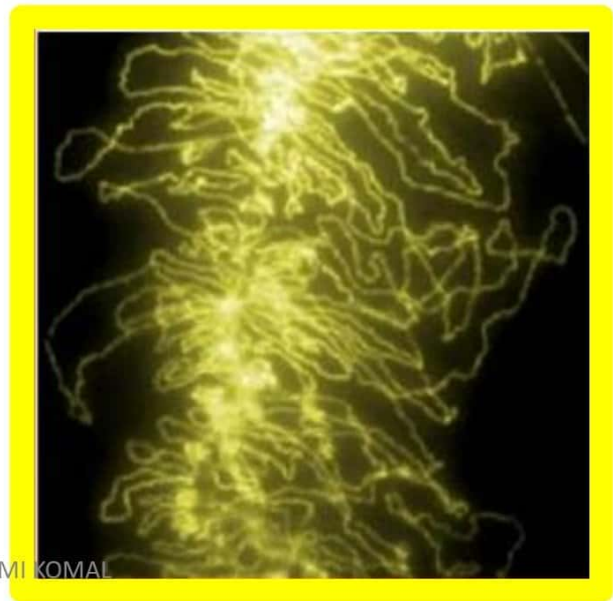
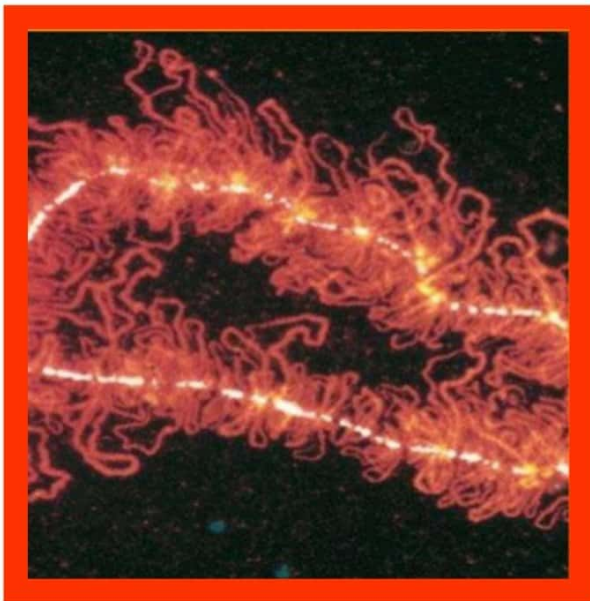


(b)



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- ❖ Usually 1-9 loops may arise from each chromomere
- ❖ Small swellings , without loops , may be present towards the end of the central axis ,they represent the telomeres
- ❖ Each bivalent may contain a loopless swelling which represents the centromere



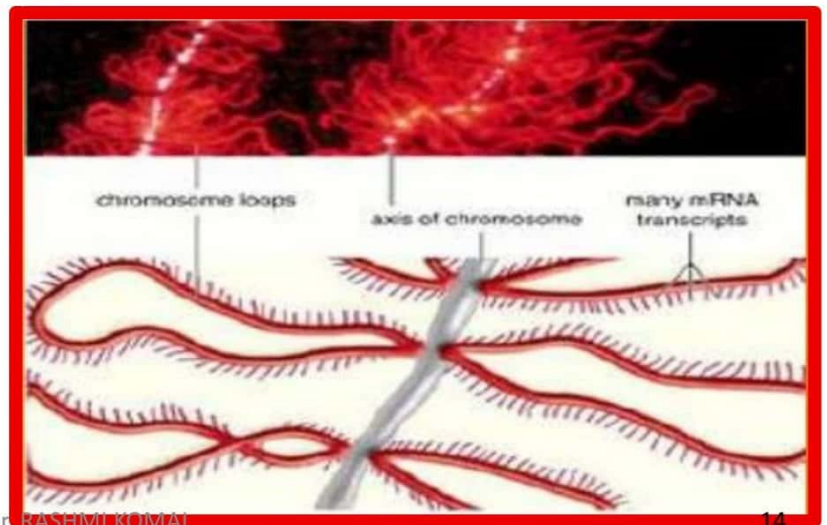
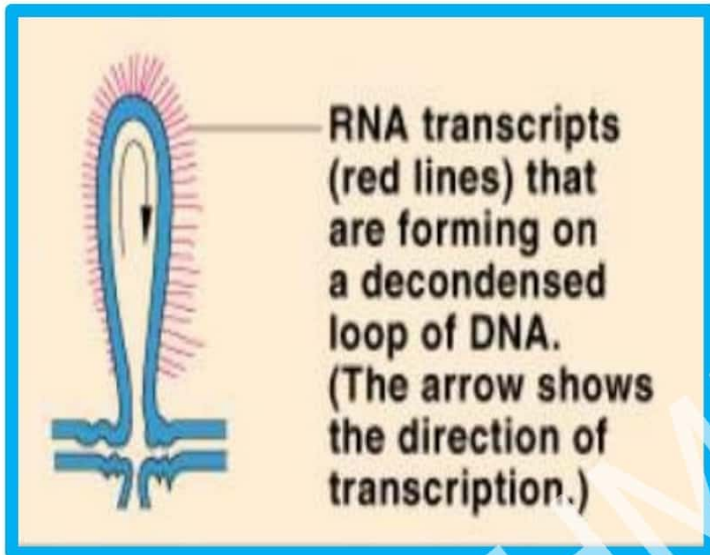
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TRANSCRIPTION OF LBC

- Transcription occurs either along the whole loop or at parts of a loop.
- At the beginning of meiosis, when DNA replication is complete, the homologous pairs lie immediately next to each other & form characteristic structures composed of 4 chromatids.
- Lampbrush chromosomes are distinguished by a high rate of RNA transcription.

FUNCTIONS OF LBC

- Lamp brush chromosomes are involved in the synthesis of RNA & proteins.
- Each loop is believed to represent one long operon consisting of repetitive cistrons.
- Each locus codes for RNA.
- The loop is supposed to synthesis at a high rate because of repetitive gene sequence.
- There are also reports that the LBC help in the formation of yolk material in the egg.



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THANKYOU