Structure of Chromosome

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What are chromosomes - The nucleic acid, more specifically, DNA is the hereditary material in almost living beings with the exception of some plant and animal viruses.

In simple prokaryotic cells, it forms a single chromosome and lies in the cell cytoplasm.

→ In eukaryotic cells DNA is contained in chromosomes, which remain isolated from the cell cytoplasm and are enclosed in a nucleus.

→ The chromosomes are capable of self-reproduction and maintaining morphological and physiological properties through successive generations.

→ They are capable of transmitting the contained hereditary material to the next generation. Hence these are known as hereditary vehicles.

Karl Nageli - (1842) observed chromosomes as rod-shaped bodies in plant cells.

Hofmeister (1848) - observed chromosomes as darkly stained bodies in pollen mother cells of Tradescantia

Waldeyer (1888) - coined the term Chromosome (chrom - color - some - body)

Walter S. Sutton (1902) - proposed "Theory of chromosomal basis of Heredity"

Euploidic chromosome - The number of chromosomes in somatic cells of higher animals known as diploid (2n)

→ No. of chromosome in some animals.

⇒ Human — 46
⇒ Grasshopper — 24
→ Drosophila — 8
→ Rana tigrina — 26
→ Mouse — 40
→ Honey bee — 42
→ Rattus rattus — 42
→ Chimpanzee — 48
→ Monkey - macaca — 42

→ Chromosomes exhibit cyclic changes in shape and size during cell cycle.

→ In non-dividing cell, the chromosomes form an interwoven network of fine twisted but uncoiled threads of chromatin. and are invisible.

→ During cell division the chromatin threads condense into chromosomes the compact structure by helical coiling.

→ In Metaphase and Anaphase these threads become short, compact bodies having definite shape and sizes.

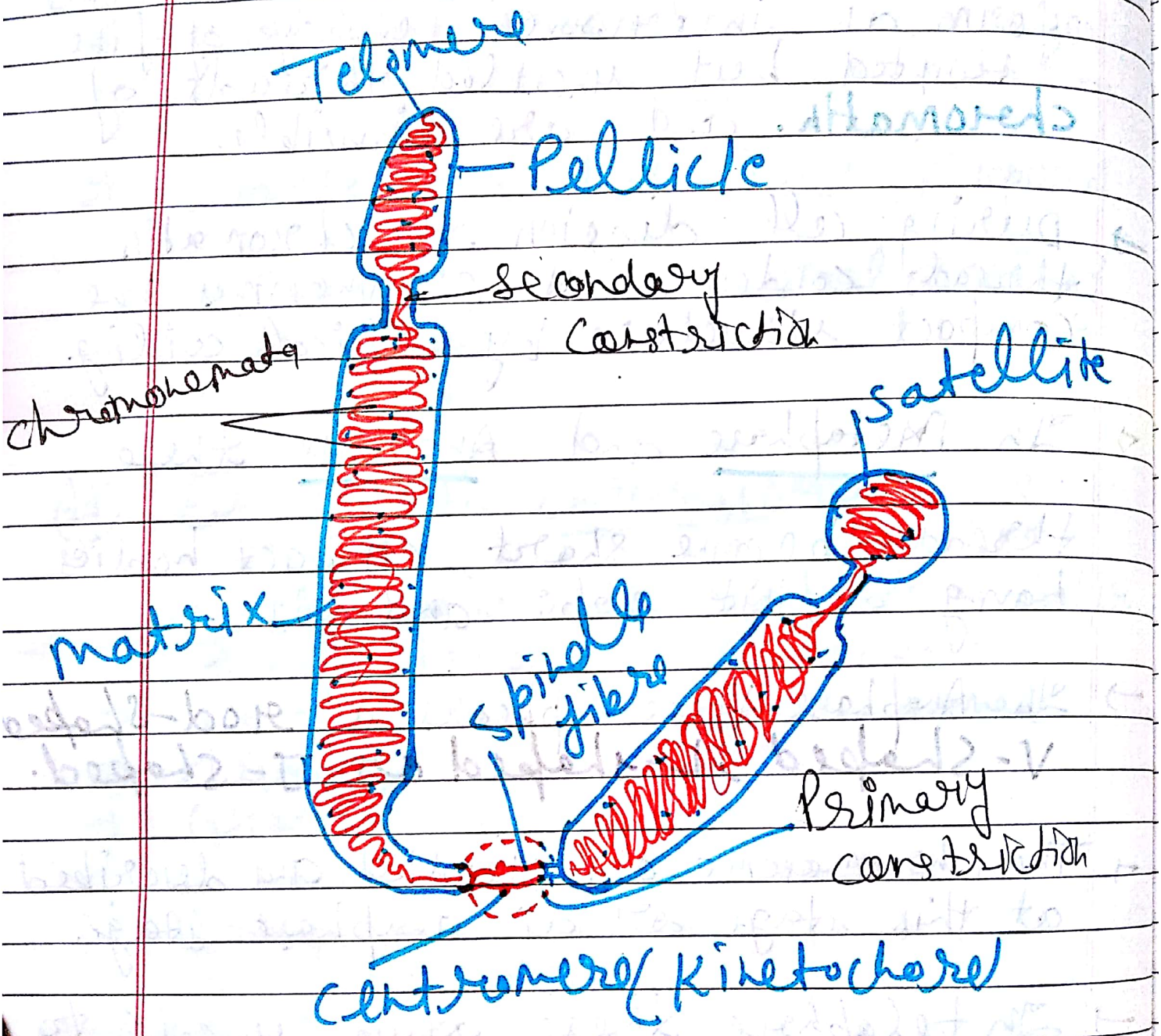
→ In Anaphase these appears as rod-shaped, V-shaped, L-shaped or J-shaped.

→ The chromosome are studied and described at this stage or at anaphase stage.

→ In telophase these again uncoil to form the chromatin net.

Size - 1 μ to 30 μ in length
0.22 μ to 2 μ in width

→ Shape - rod shaped, twisted or spiral, curved or filamentous.



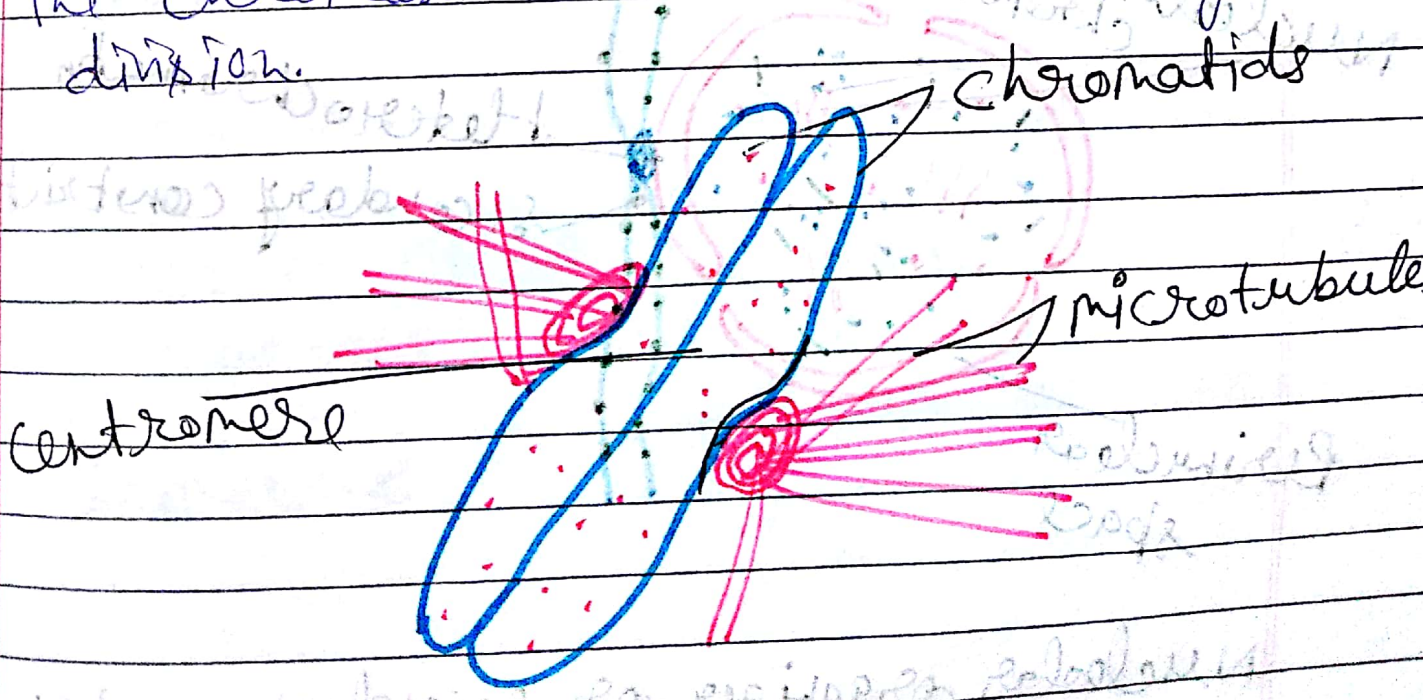
Structure of an anaphase chromosome

① Primary constriction and centromere

→ A part of the chromosome is marked by a constriction.

2. It is comparatively narrow than the remaining chromosome. It is known as primary constriction.
3. Its position is constant for a given chromosome and forms a feature of identification.
4. It divides chromosome into two parts or arms.
5. It shows a faintly positive Feulgen reaction, indicating presence of DNA of repetitive type.

→ This is called centromeric heterochromatin.
→ Centromere lies in the region of primary constriction.
→ The microtubules of the chromosomal spindle fibres are attached to the centromere. Therefore, centromere is associated with the chromosomal movement during cell division.



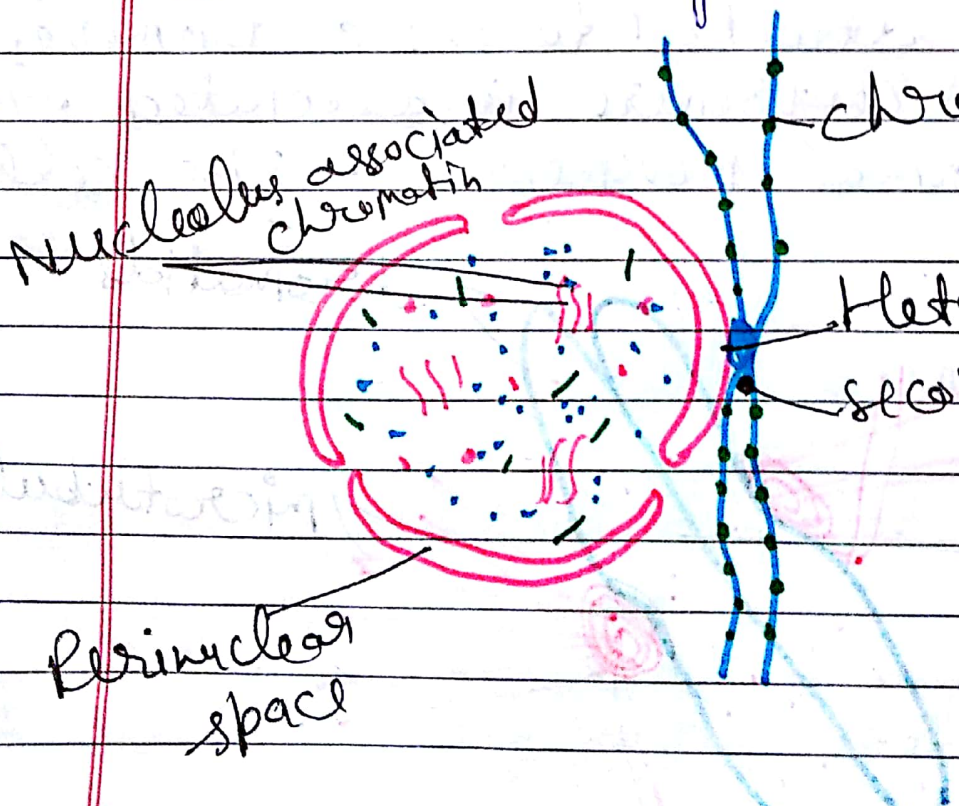
2. Secondary constriction-

→ Sometime one or both the arms of a chromosome are marked by a constriction other than the primary constriction.

→ During interphase this area is associated with the nucleolus and is found to participate in the formation of nucleolus.

→ It is, therefore, known as nucleolar organizer region or the secondary constriction.

→ Its location on the chromosome is marked with a lightly stained constricted region.



Nucleolar organizer or secondary constriction and its association with nucleolus

→ The genes of nucleolar organizer region responsible for formation of 18S and 28S ribosomal RNA and nucleolus.

→ Its location in the chromosome is marked by a lightly stained constricted area and is constant for a given chromosome.

→ Telomere - The tips of the chromosomes are rounded and sealed and are called telomeres.
- These provide stability to the chromosomes and protect their association with other parts of the homologous or non-homologous chromosomes, whereas the broken ends may join.

→ Satellite - The terminal part of a chromosome beyond secondary constriction is called satellite.

- It has a constant shape and size for a particular chromosome. The chromosome with satellite is known as sat-chromosome.