TELOMERS AND THEIR ROLE IN AGEING.

KUMARI SONA RANI

ASSISTANT PROFESSOR

DEPARTMENT OF BOTANY

S.SINHA COLLEGE AURANGABAD

FOR M.Sc 4TH SEM. STUDENTS

The repetitive DNA found at chromosome's ends, function to protect the DNA or genes is known as telomere or telomeres of chromosomes." The DNA of us is situated on chromosomes- a complex network of protein and nucleic acid. The number of chromosomes varies between different organisms. For examples, 23 pairs of chromosomes are present in human.

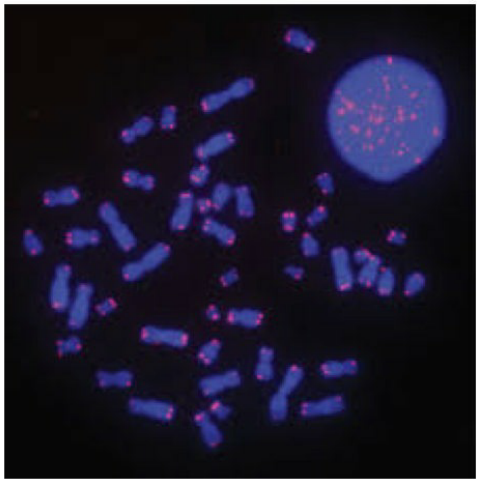
All nuclear DNA of humans is located on those 46 chromosomes. Also, inherited it to consecutive generations.

Centromere, telomere and arms are three different structure of chromosomes. The centromere is located in the centre. The arms contain all genes and the telomeres are located on the ends of each chromosome

What is a telomere?

In 1939, *Muller* and *McClintock* concluded that some specific sequences present at the end of the chromosome prevent chromosome fusion. Those are telomeric sequences.

Telomere : ***Telos*** = end, ***meros*** = part



As we said, the human chromosome is a complex network of proteins and DNA. Histon proteins like H1, H2A, H2B, H3 and H4 interacts with DNA and arrange it like bead-on-string structure.

Genes are located on the arms of chromosomes. And inherited with it. The telomeres protect genes from damage.

In 1975, Blackburn E, Gall JG discovered telomeres and explained their repetitive nature.

In 1983, McClintock B who discovered the transposons had explained the role of telomere end in chromosome stability.

However, the end replication problem was postulated by Olovnikov A during ‘70.

The enzyme telomerase was discovered and characterised in 2009.

Definition:

The repetitive DNA found at chromosome’s ends, function to protect the DNA is known as telomere or telomeres of chromosomes.

Structure:

The special types of repeated sequences present on the telomeres(AGGGTT) make them unique from other regions of the chromosomes. The overhanging polynucleotide sequence present on telomere is six nucleotide sequence made up of TTAGGG. Also known as Hexa-repeats.

The terminal end of the Hexa-repeat has single-stranded Guanine reach overhang. The six nucleotide sequence present from 2500 to 3000 time on each human chromosome.

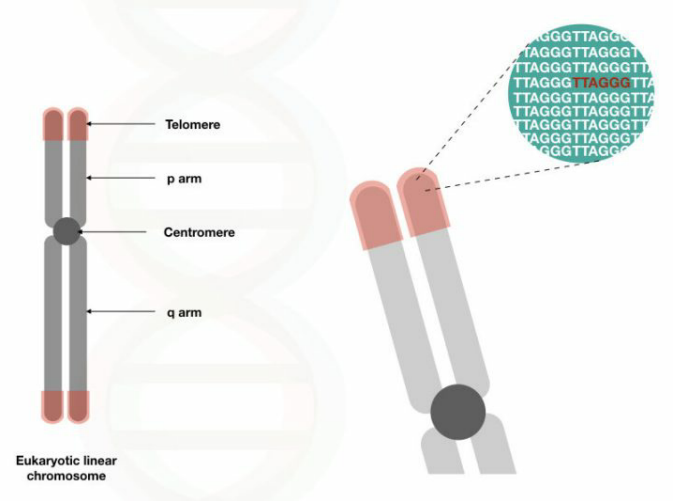
Notably, it is 15,000 nucleotides long.

The special Kind of TIP (**Telomeric interacting proteins**) and the Hexa nucleotide repeats of the telomeres provide the structural hierarchy to the telomere.

The 6 basepair repeats are tandem repeats and are conserved since the evolution.

Conclusively the characteristics of the telomere are,

- Six nucleotides overhang- TTAGGG
- Repetitive DNA sequence
- Tandem repeats
- Non-coding
- Conserved since evolution



- *The location of telomere and telomeric overhang sequence-TTAGGG.*
- The DNA is made up of the long chain of A, T, G and C bases, phosphate backbone and the sugar. Read more on the structure of DNA…. click here
- Notably, the telomeres are only present in eukaryotes. As the prokaryotic chromosomes are circular, it doesn't have telomeres.

Function:

- The prime function of it is to protect the genetic information of cells.
- In addition to this, by capping the ends of chromosomes, it helps chromosomes to fit inside the cell nucleus.
- It protects the fusion and deterioration of chromosomes.
- It prevents cancer and induces senescence.
- It facilitates proper replication. Hence it protects genes from facing end replication problem.

Telomere and ageing:

Progressive reduction in the function of the cell or tissue causes mortality; is called as an ageing process.

As we age, the functional capability of the cell decreases gradually. The ability of a cell to produce energy, the rate of synthesis of new biomolecules and the rate of replication decreases as well.

“Shorter the telomere, shorter the lifespan of an organism”

As the ageing of an organism depends on the length of the telomere. This means organisms with longer telomeres lives longer (for example human) as compared with short telomere (for example dog and mice).

Nonetheless, telomere shortening is not the only reason for the ageing. So is it possible to increase lifespan by decreasing the rate of telomere shorting?

Well, theoretically, telomerase enzyme can do so. If we increase the expression of the telomerase gene in somatic tissues, we can live longer. Just an assumption!

Practically, it is not possible. Yet, telomerase therapy can do so. However, it can also cause unknown cancer. Or we don’t know what else will happen.

As we know, only telomerase enzyme can prevent telo-shortening, thankfully it is not present in somatic cells.