

Zoo-342 Molecular biology  
Lecture 4

**Centromere and Telomere**

- Two regions of the eukaryotic chromosome, the **centromere** and the **telomeres**, have specific functions.
- The **centromere** plays a critical role in chromosomal movement during mitosis and meiosis.
- The **telomeres** terminate the linear chromosomes.



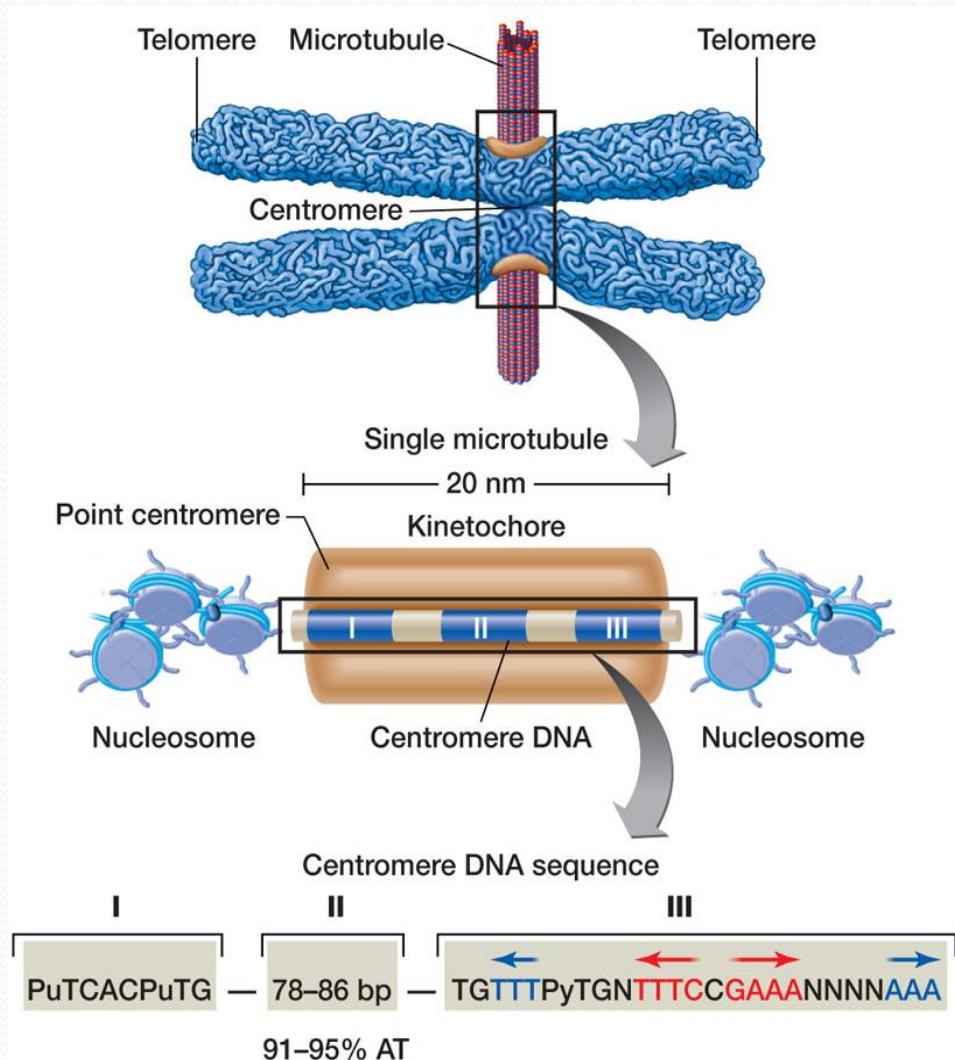
## Centromeres:

- There is a distinct between centromere and kinetochore. The **centromere** is the visible constriction in the chromosome that contains **specific DNA sequences**, whereas the **kinetochore** is the **proteinaceous** interface between the centromere and the spindle microtubules.
- Centromeres appear to serve **two** important **functions** in the cell:
  - 1) They are the sites at which the kinetochores associate.
  - 2) They are essential in keeping the sister chromatids together during mitosis and meiosis.

- Most of our knowledge of the genetics of centromeres has come from work in **yeast** (*Saccharomyces cerevisiae*).
- In a **yeast** cell, only **one** spindle microtubule attaches to the centromere. This region is called a **point centromere** (Figure 1).
- **Higher eukaryotes** have larger centromeric regions that attach **more** spindle microtubule. This region is called regional **centromeres**.
- The **location** of the centromere along the length of the chromosome can be used to **categorize** chromosomes within a species and to **identify** a specific chromosome.



- The yeast centromere is about 250 bp long with **three** regions.
- The 250-bp long yeast centromere is about 20 nm.
- Pu represents any purine.
- Py represents any pyrimidines.
- N represents any base.
- The arrows appear over inverted repeat sequences.



**Figure 1: Organization of a yeast centromere**

## Telomeres:

- Telomere have several specific functions:
  - 1) Telomeres must prevent the chromosome ends from being degraded by **exonuclease**.
  - 2) Protects the end of the chromosome from fusion with neighboring chromosomes.
  - 3) Allow chromosomal ends to be properly replicated.
- Most telomeres isolated so far are a sequence of **five to eight** bases that is repeated hundreds or thousands of times at each end of every chromosome.
- In human beings, the telomere sequence is 5'-**TTAGGG**-3' repeated 300-500 times at the end of each chromosome.
- The telomere region of a linear chromosome contains a 3' single-stranded DNA overhang.



## Telomere sequences in eukaryotes

Organism	Telomere Repeat (shown 5' to 3')
Human beings, other mammals, birds, reptiles	TTAGGG
Trypanosomes	TTAGGG
Holotrichous ciliates ( <i>Tetrahymena</i> )	TTGGGG
Hypotrichous ciliates ( <i>Stylonychia</i> )	TTTTGGGG
Yeast	TG, TGG, and TGGG
Plants	TTAGGG

## Telomeres

