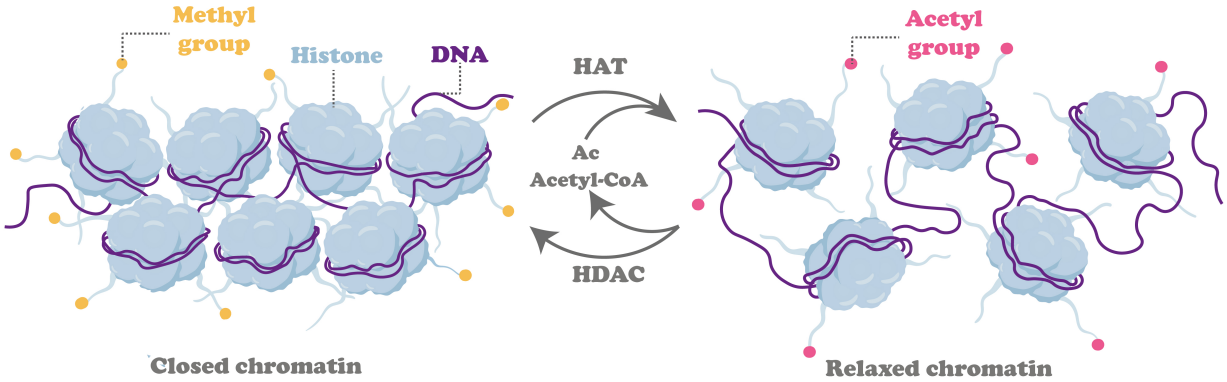
CONCEPT: EUKARYOTIC CHROMOSOME STRUCTURE

- Eukaryotic chromosomes have a specific _____
  - □ **Chromatin** is a combination of DNA and protein
    - **Heterochromatin** is tightly packed DNA
    - **Euchromatin** is loosely packaged DNA

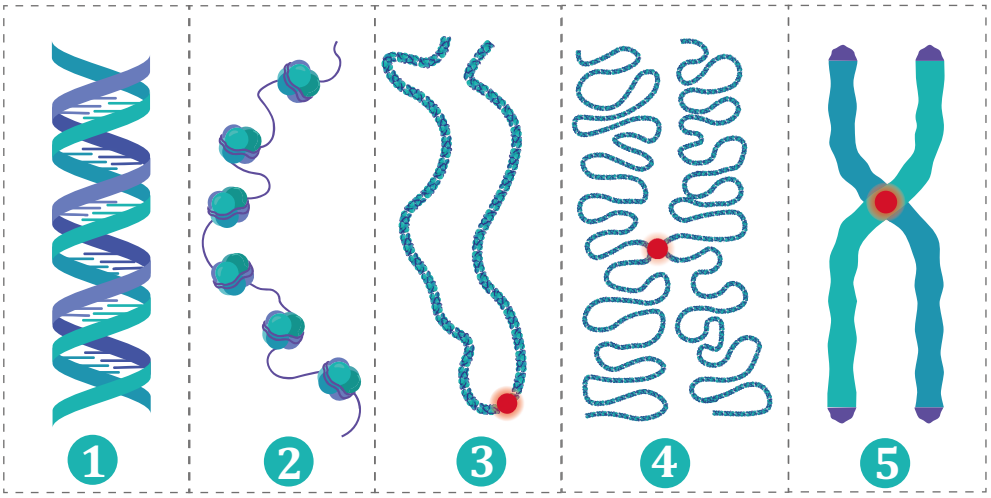
EXAMPLE:



Structures

- Chromosomes are packaged into four levels
  - □ The **Nucleosome** is made up of *histone proteins* and DNA
    - **Histone core** consists of two copies of H2A, H2B, H3, H4
    - **Histone linker,** H1, connects the histone core
  - □ **30nm fiber** is composed of multiple nucleosomes
  - □ **250nm fiber** is composed of 30nm fibers

EXAMPLE:



● The chromosomes have specific _____

□ The **centromere** is the constricted region of the chromosome where spindle fibers attach

- **Kinetochore** is a group of cellular proteins that link centromeres to spindle fibers

- Contains heterochromatin and sequences where the kinetochore attaches

- Contains a special histone variant **cenH3**

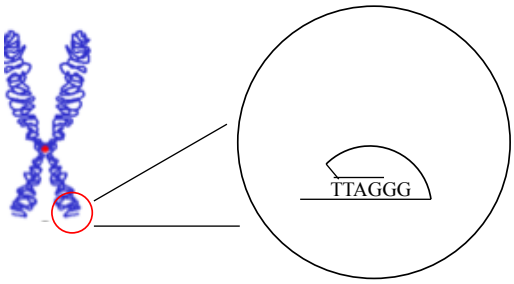
□ The **telomere** is the end of the chromosome

- Contains repetitive **telomeric sequences**, which are repeats of A and T followed by 2-3 Gs

- **Shelterin** is a protein that binds to telomeres and prevents DNA from breaks at the ends

- Has G rich 3' overhang, that assists in replication

EXAMPLE:



Supercoiling

□ **Supercoiling** is an extremely tight _____ of chromosomes

- **Positive supercoiling** describes DNA molecules that are over-rotated

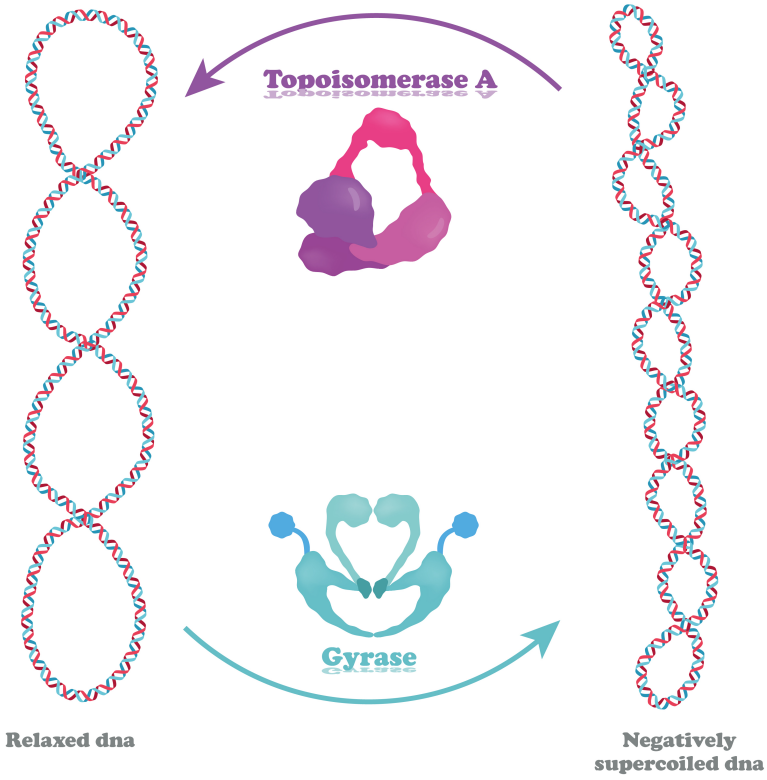
- **Negative supercoiling** describes DNA molecules that are under-rotated

□ **Topoisomerases** are enzymes remove rotations from DNA

- **Type I** - relaxes the number of negative supercoils

- **Type II (DNA Gyrase) –** introduces negative supercoils, to remove positive supercoils

EXAMPLE:



PRACTICE

1. Which of the following terms is used to describe “open chromatin” which is loosely packaged DNA?
    a. Heterochromatin
    b. Achromatin
    c. Euchromatin
    d. Mochromatin

2. Histone proteins are responsible for what?
    a. Separating genes on the chromosomes
    b. Packaging the chromosome
    c. Bringing distant regions of chromosomes together
    d. Separating chromosomes

3. Which of the following is the correct order of chromosomal packaging levels?
    a. Nucleosome, 250nm fiber, 30nm fiber, chromosome
    b. 250nm fiber, 30nm fiber, nucleosome, chromosome
    c. Nucleosome, 30nm fiber, 250nm fiber, chromosome
    d. Nucleosome, 30nm fiber, chromosome, 250nm fiber

4. What is the name of the enzyme that removes supercoils in DNA?
    a. Ligase
    b. Polymerase
    c. Topoisomerase
    d. Kinase