

Build a Chromosome

Student Instructions

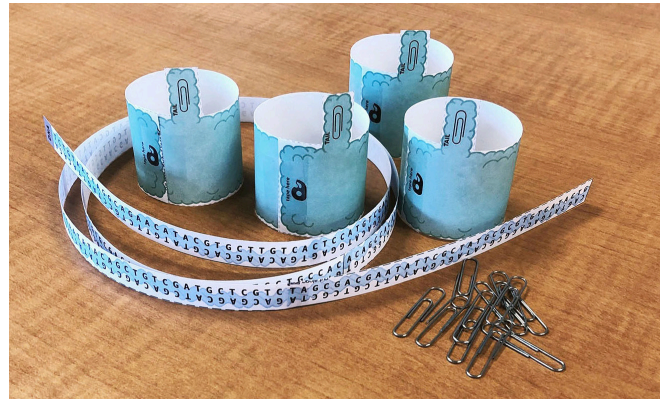
Background

Each chromosome is made of a long strand of DNA wound around spool-like molecules called histones. This keeps a cell's DNA organized, untangled, and accessible to gene reading machinery.

You will build paper models of chromosomes to explore how DNA is organized in dividing and non-dividing cells.

Prepare Your Materials

- Cut out the histones. Tape the ends together to make 4 separate "spools."
- Cut out the DNA strips. Tape the gray ends together to form one long ribbon.
- Gather 12 paper clips.

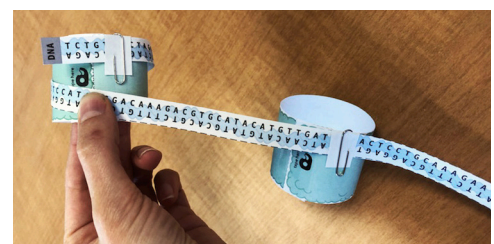
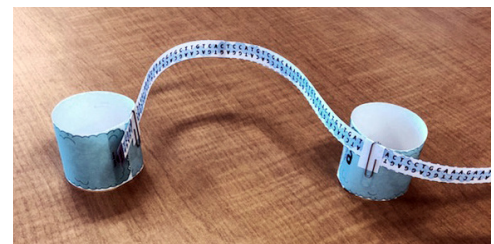


NON-DIVIDING CELL

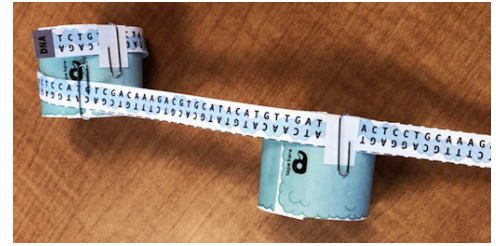
In a cell that is not dividing, DNA is coiled loosely around histones. The histones keep DNA organized so it fits into the nucleus, and gene reading machinery can access the appropriate pieces.

Relaxed Chromosome

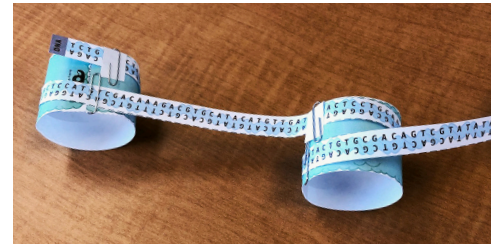
1. Locate one of your prepared histone spools and your DNA ribbon. Place one end of the DNA ribbon onto a histone. Fold the histone tail over the DNA to help hold it in place. Secure it with a paper clip.
2. Attach the remaining histones along the DNA ribbon. Place them at a distance of 2 DNA strips apart (about 16 cm).
3. Hold the first histone upright in one hand. Wind the DNA ribbon around it one time. There should be space between the first histone and the next one. If they are touching, unwind the DNA ribbon a little bit to put some space between the histones.



4. Secure the DNA ribbon with a paper clip. Make sure neighboring histones do not touch one another.



5. Trying not to fold or bend the DNA ribbon, wind it once around the next histone. Again, be sure that no part of neighboring histones are touching. Secure the DNA ribbon with a paper clip.



6. Repeat until the DNA ribbon has been wound around all of the histones. The histones and DNA should be spooled loosely, with some space between the histones.



Save your Relaxed Chromosome model. You will need it for the next part of this activity.

DIVIDING CELL

When a cell divides (or gets ready to divide), DNA is coiled tightly around histones. The chromosomes are very condensed compared to a non-dividing cell, and gene reading machinery does not have access to the DNA. After cell division, chromosomes return to their relaxed state.

Condensed Chromosome:

7. Locate the Relaxed Chromosome model you built in the first part of this activity.

8. Hold the first histone upright in one hand. Continue to wind the DNA ribbon around it approximately one more time, or until you bump into the next histone.



9. Secure the DNA ribbon with a paper clip. Make sure the neighboring histones are touching one another.

In a real cell, a length of DNA wraps around a histone about 1.7 times. Histone tails stabilize the structure, like they do in your model.



NAME _____ DATE _____

10. Trying not to fold or bend the DNA ribbon, wind it around the next histone. Again, make sure the neighboring histones are touching, and secure the DNA ribbon with a paper clip.



11. Repeat until all of the DNA ribbon has been wound around all of the histones. The histones should begin to stack on top of one another as you wind.

