

DNA Packaging – A Challenge

There is a very large amount of DNA in *each* nucleus of *each* cell of our body. In fact the DNA of each chromosome is almost 3 inches long and we have 46 chromosomes in *each* cell! How can the DNA fit into a thing so small we need a microscope to see it?? Well, DNA must be properly “packaged” to be able to fit into such a tiny space.

In this activity, you will use a length of thread to represent DNA, our genetic material, and an empty gelatin capsule to represent the nucleus, or control center, of the cell.

1. Your first challenge is to cut 2 pieces of thread (use 2 different colors) to be 8 meters long each, without knotting or tangling the thread.

What method did you come up with?

2. Now the real challenge: you must figure out how to put your two pieces of “DNA” into your “cell”. Yes this is 16 meters total and if done properly it will fit!!

a. What ways did not work?

j. What method finally worked?

3. This model has been enlarged 80,000 times compare to the size of real human DNA! Now we want to figure the *real* length of human DNA in each cell.

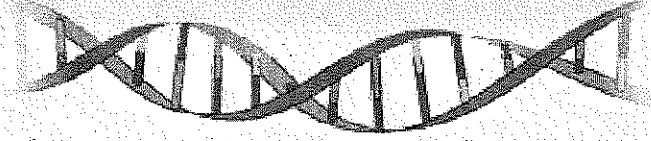
We used 16 meters of thread to represent our DNA. We need to divide the length of the thread by 80,000 to get the real human length in meters. The equation is started for you below; finish the calculations to determine the real human length in meters.

$$\frac{16}{80,000} = \quad \text{meters}$$

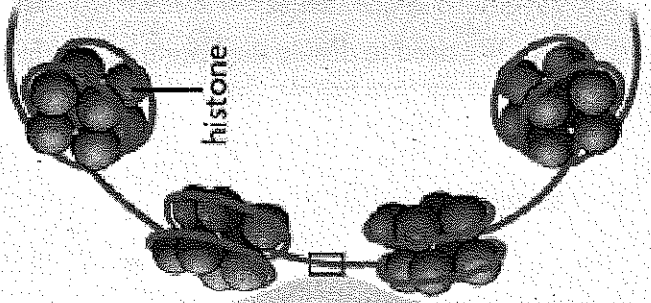
This means that there are those many meters of DNA in *each* cell!!!

4. What do you think the whole point of doing this activity was?

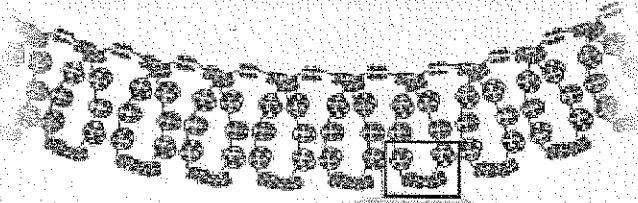
DNA condenses tightly during the early stages of mitosis.



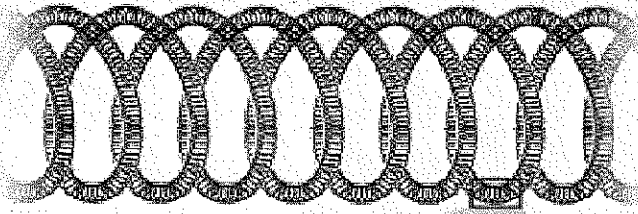
DNA double helix
Each continuous, double-stranded DNA molecule makes one chromosome.



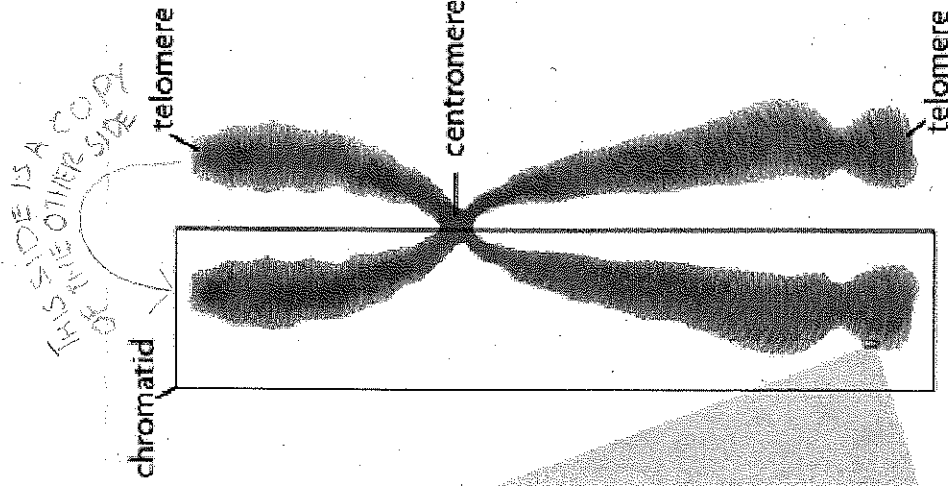
DNA and histones
DNA wraps at regular intervals around proteins called histones, forming chromatin.



Chromatin
Interactions between parts of the histones further compact the DNA.



Supercoiled DNA
The chromatin coils more and more tightly around organizing proteins.



Condensed, duplicated chromosome
The condensed, duplicated chromosomes can be aligned and separated during mitosis.