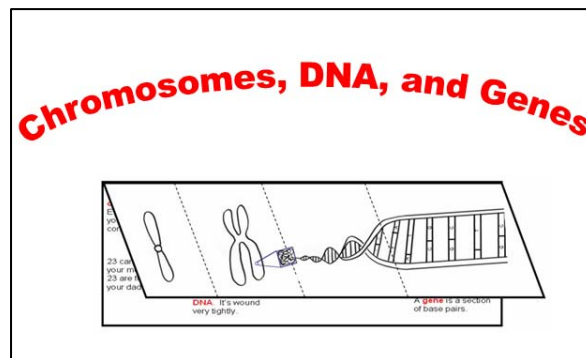


# Teacher Notes- “Chromosomes, DNA, and Genes- Roadmap To Understanding The Foundation Of Genetics”

Some things you just have to understand before you can move on. In math, addition and subtraction come before multiplication.

And with genetics, you’ve got to understand chromosomes, DNA, and genes before anything else can make sense. DNA is something they’ve heard of hundreds of times. Now it’s time to show them what it is.

If you use this lesson in combination with another one of ours called “DNA Chain” you’ll have a solid foundation on which you can build upon. And not only will students lose their fear of the words “chromosome” or “DNA”, but they’ll know *exactly* what you’re talking about!



## Materials per student:

- Ruler
- Scissors
- 1 Clean sheet of copy paper

## Additional Teacher Materials:

- 1-ball of yarn or string – (to refer to when explaining the difference between a chromosome and DNA)
- PowerPoint-“Chromosomes, DNA, & Genes”

## Beforehand:

1. There are 2 ways you can do this lesson. One way is by leading with the PowerPoint (which is preferable) and the other is with the optional student handout only. Using the PowerPoint keeps everyone together, prevents students from rushing through, and allows you the opportunity to make relevant comments. These you cannot do that with just the handout. We included it in case you have no access to a multimedia projector, and for your absentee kids to make up the lesson.
2. Find and insert an actual photo/image of a chromosome onto PowerPoint slide #8 to help you talk through paragraph 1. A close-up showing the DNA strands is ideal. Show them a real living chromosome, and watch their eyes light up. To

insert a picture from a website, right-click it, “copy”, then come back to the PowerPoint and right-click “paste”.

3. Make copies of the ½ page homework handout.
4. Take 15 minutes and go through the activity yourself. You’ll know then what students are going through, and you’ll have something to hold up during class.

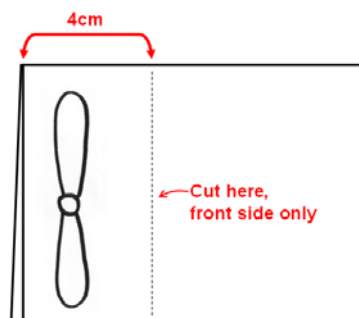
**Procedure:**

1. In your introduction, talk about how some things are scary until you find out more about them. It’s all attitude- once you “let down” your fears, usually with the aid of information, things are not scary, and begin to make sense. Usually, the scary thing itself does not change, you do.
2. Mention the purpose of this lesson: **to simply explain what chromosomes, DNA, and genes are:**

“The purpose of today is to help every one of you understand 3 important words we’ll be seeing a lot of in the next 2 weeks: chromosomes, DNA, and genes. These words sound scary. In fact just imagine I called you name and asked you to tell me exactly what DNA is. What would you say?”

The good news is that I’m not going to do that. But it illustrates my point. We’ve heard these words hundreds of times, but we don’t really understand what they are or mean. When you leave you’ll all completely understand all 3 terms. Don’t you feel better already?”

3. If you’re just beginning a chapter on genetics, you can take a couple of minutes and picture read the chapter, which is to flip to the chapter and notice what’s there, what’s coming. Doing that will also help students see the importance of today’s lesson.
4. Begin the PowerPoint and make sure students have a sheet of blank copy paper.
5. As directed by slide #2, have students turn their papers long-ways and then fold the paper in half.
6. Before drawing the first chromosome, make sure that everyone’s paper has the fold is on top (as shown on slide #3). It’s going to be a very long day if they’ve got it turned around the wrong way.
7. Click through the rest of the slide, which shows students how to draw a single chromosome one part at a time\*<sup>1</sup>, and then where and how to cut the first flap.



Even with the instructions on the screen, you know it's not enough to expect every student to just cut through the front sheet of paper only. Actively watch your students who normally do things wrong.

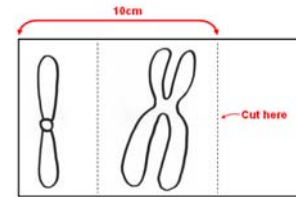
- Now, let's lift the little flap we just made and write down a couple of basic things about this chromosome. As students do this, feel free to make an extra comment or two about chromosomes.
- This would be a good time to re-remind everyone what the big picture is:



“What we just did doesn't seem like a big deal, but do you realize that you now know what a *chromosome* is? 10 minutes ago, you were scared of it, and now it's not scary at all. And now that you know what a chromosome looks like, every time we use the word chromosome in here, just think of what you just drew, because that's all a *chromosome* is.”

- Next, we'll draw a chromosome *pair*, make another cut, lift the flap and write a few more notes.

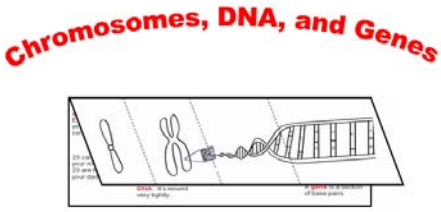
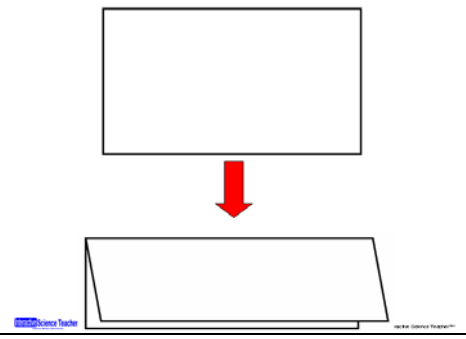
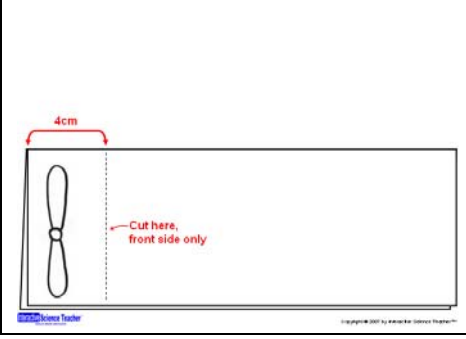
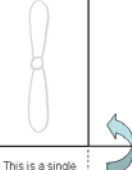
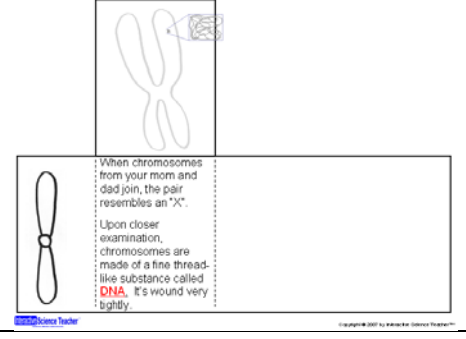
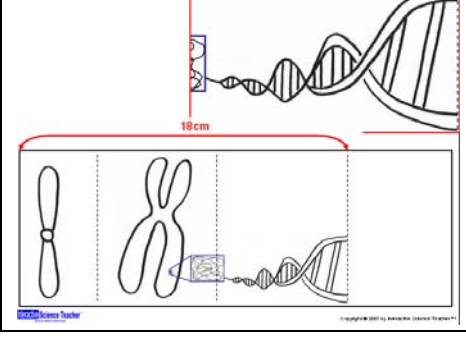
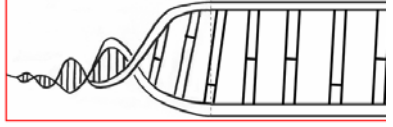
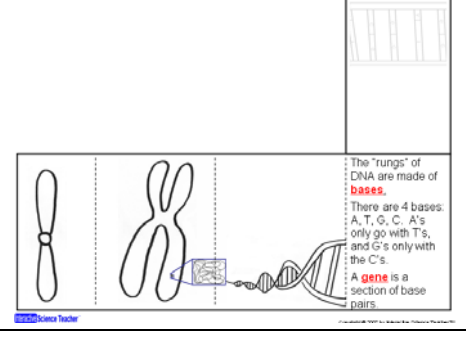
Notice we've got a system going now: draw, cut, take notes.



*(end of Teacher Notes preview)*

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 <p style="text-align: center;"><b>Chromosomes, DNA, and Genes</b></p>		 <p style="text-align: center;">4cm Cut here, front side only</p>
 <p>This is a single <b>chromosome</b>. Every cell in your body contains 46 of them. 23 came from your mom, and 23 are from your dad.</p>	 <p>When chromosomes from your mom and dad join, the pair resembles an "X". Upon closer examination, chromosomes are made of a fine thread-like substance called <b>DNA</b>. It's wound very tightly.</p>	 <p style="text-align: center;">10cm</p>
	 <p>The "trungs" of DNA are made of <b>bases</b>. There are 4 bases: A, T, G, C. A's only go with T's, and G's only with the C's. A <b>gene</b> is a section of base pairs.</p>	<h2 style="text-align: center; color: red;">Homework</h2> <p style="text-align: center;">•So what is it about DNA that makes you you?</p>
<p><b>◆ Student homework assignment</b></p>	<p><b>◆ Answers to homework</b></p>	<p><b>◆ Quick Notes</b></p>

**Instructions:** Copy the 3 paragraphs below onto the back side of your Roadmap. Fill in the blanks as you go. Try not to have too much fun.

A, T, G, C	4	30,000
genes	DNA	gene
codes	2	sequence of base pairs
billion	height	people
99,999	bases	gender
chromosome	3,000	4

- So what is it about      that makes you you? It's the exact order of these      or rungs. Even though there's only      bases (    ,     ,     ,     ), there are over      sets. That's how you can get so many kinds of      from only 4 ingredients.
- code for things like      and sensitivity to x-rays. Most genes sections are about      base pairs long. The person next to you has a height slightly different because that      or      on that chromosome, is slightly different than yours. But different as you may be, you're still     % genetically identical to them.     !!!
- Would you believe the human body has about      genes? It's true! Each      contains the blueprint that      for hundreds of genes. For example, the gene for cataracts is on chromosome #     .

**Instructions:** Copy the 3 paragraphs below onto the back side of your Roadmap. Fill in the blanks as you go. Try not to have too much fun.

A, T, G, C	4	30,000
genes	DNA	gene
codes	2	sequence of base pairs
billion	height	people
99,999	bases	gender
chromosome	3,000	4

- So what is it about DNA that makes you you? It's the exact order of these bases or rungs. Even though there's only 4 bases (A, T, G, C), there are over 3 billion sets. That's how you can get so many kinds of genotype from only 4 ingredients.
- Genes code for things like gender, height, and sensitivity to x-rays. Most genes sections are about 3,000 base pairs long. The person next to you has a height slightly different because that gene or sequence of base pairs on that chromosome, is slightly different than yours. But different as you may be, you're still 99,999% genetically identical to them. Ku!!!
- Would you believe the human body has about 30,000 genes? It's true! Each chromosome contains the blueprint that codes for hundreds of genes. For example, the gene for cataracts is on chromosome # 2.

### Teacher Quick Notes - "Chromosomes, DNA, and Genes"

**Materials per student:**

- Roller
- Scissors
- 1 Clean sheet of copy paper

**Additional Teacher Materials:**

- 1-roll of yarn or string—to refer to when explaining the difference between a chromosome and DNA
- PowerPoint—"Chromosomes, DNA, & Genes"

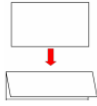
**Procedure:**

1. Introduce the lesson by stating the purpose of this lesson: to simply explain what chromosome, DNA, and genes are.
2. Use the PowerPoint to show students how to fold the paper in half.
3. Continue following the slides, in which students repeat a process of making a drawing, cutting a flap, and then writing notes below the flap. It begins with a single chromosome, then onto a chromosome pair, and then onto DNA.
4. Hand each student a copy of the homework. They need to copy the sentences, with answers included, onto the back of the paper they just made.

## ◆ Instructions on paper (4 pages)

### Chromosomes, DNA, and Genes

1. Fold your paper in half, long-ways.



2. Draw a chromosome to the left, as shown.



3. Cut through the first side to make a flap to the right of the chromosome. Don't cut through the paper in back!

4. Lift the flap and copy these words inside, beneath the single chromosome:

This is a single **chromosome**. Every cell in your body contains **46**. **23** came from your mom, and **23** are from your dad.



5. Close the flap and draw a chromosome pair. Then cut another flap to its right.



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## ◆ Drawings & Pictures



Base Pairs



Centromere



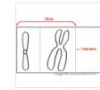
Centromere And Upper



Chromosome Pair



Chromosome Pair, DNA Close-Up



Chromosome Pair, Flap 2



DNA Close-Up



DNA Unwinding, 1



DNA Unwinding, 2



Finished Product



Single Chromosome



Single Chromosome, Flap 1



Single Chromosome, Flap 1 Lifted, Notes



Title

