

# Teacher Notes- “Diluting Your DNA”

Question: What's everyone's favorite subject? Answer: Themselves! In this lesson students watch their DNA travel through their descendants. Oh, and they learn a little something about DNA too.

## Materials per student:

1-Student Handout (see last page)

1-Penny

## Additionally:

PowerPoint- “Diluting Your DNA” (see last page)

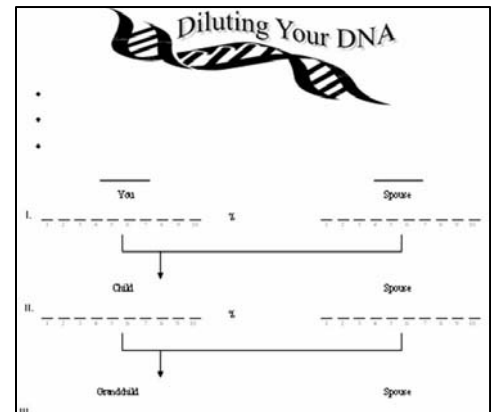
Ball of yarn or string (optional)- to help students understand the difference between a chromosome, DNA, and a gene

## Beforehand:

1. Go through the lesson on your own before you teach it, so you're comfortable and know what to expect. It will also help you communicate it better.
2. Pick out a section of your book to read from, if you so choose. Read just a page or two at the most. Choose something that hits one of your particular standards. Insert the page number on the first PowerPoint slide.
3. Stick a few extra pennies in your pocket. A few will get dropped/lost throughout the day.
4. Remember to use good “social manners” as you speak today about moms and dads, because you know that some home situations for kids are not good. While it's true that every student has a biological mom and dad, still keep things professional.

Also, in this activity when it's time to parent a child and pass along DNA, notice they join with a “Spouse”. We all realize that there are many ways of becoming a parent, but this is a lesson is about genetics, not values.

5. This lesson does oversimplify many genetic concepts (like how many traits there are, and dominant and recessive genes), but you could use that to your advantage by pointing these out during the lesson. Use this occasion to mention how there really aren't any perfect models and illustrations in science. The lesson was intentionally kept simple and compact so it could focus on and teach just one concept- the “diluting of DNA”. It also gives you room to add where you want.




**Procedure:**

1. Have the PowerPoint with the “Diluting Your DNA” banner running as students enter. (If you don’t have a multimedia projector, print the first 2 PowerPoint slides and put them on an overhead transparency).
2. Introduce the activity:

“Students, this lesson is about your DNA- where it came from, and where it’s going. We all know that children get their DNA from their parents. But when your children have children, what happens to your DNA as more people enter the picture?”

3. Reveal the 3 bulleted statements at the top and have students copy. These set the tone and give you an opportunity to touch back on anything you’ve done with genetics recently.
4. At the bottom of the first PowerPoint slide a prompt will direct students to a page in their books for a class reading.\*<sup>1</sup>
5. Moving into the activity, students first need to choose a letter of the alphabet to represent them. It can be any letter, but it usually ends up being their first initial. Have them write that letter 10 times on each of the 10 blanks next to the Roman numeral I. Click through the beginning of slide #2 as you talk:



**Diluting Your DNA**

- a child inherits its genes from both parents
- typically, half of the genes come from each parent
- this activity will focus on how genetic differences accumulate over generations

“Those 10 letters you just wrote represents your DNA, or more specifically, 10 of your traits. In reality, you have more than 10.\*<sup>2</sup> But 10 is all we need to make our point today.

At the end of the line is a little percent symbol. What that’s asking is how much of the DNA on that line is yours. Well, how much does your DNA have in common with itself? (*it’s the same*). Right! You are 100%, pure, *YOU*, aren’t you? Put down ‘100’ in front of the percent.”\*<sup>3</sup>

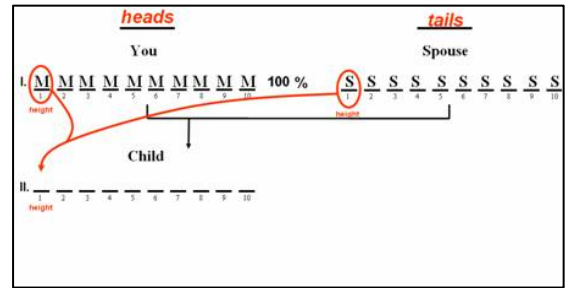
6. Now move onto their future spouse. Have them assign a different letter to their spouse, and write it 10 times, just like they did for theirs.

You										Spouse									
1.	M	M	M	M	M	M	M	M	M	100 %	S	S	S	S	S	S	S	S	S

7. First comes love. Then comes marriage. Then comes along a screaming kid. And whether students realize it or not, their ability to choose is now over. Since they have no control over their own DNA, all they ever chose was their spouse’s DNA. Little observances like this you’ll want to take pause and notice as you go through this activity. These comments will slow down the activity and give extra time for things to soak in. Time is no issue, you’ll get the activity done, even with lots of discussion and questions. So have students think about this “child” they are about

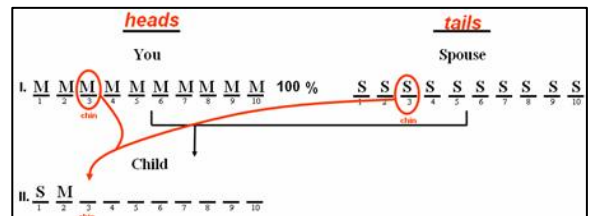
to have. Where will it's DNA come from? Whose eyes will it have? How many of my genes *should* it get? Compare that later with how many it *did* get.

- Trait #1 in the child is for height. You and your spouse both have that gene, you're both different heights, and the kid can't be both at once, so all we need now is a method to determine which one it will be. In this activity the penny will do that for us. Have students write "heads" just above where it says "You", and "tails" above "Spouse".



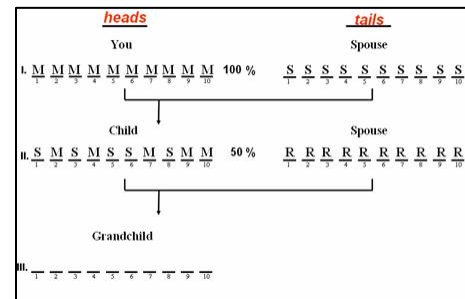
- Have students flip their coin once\*<sup>4</sup>. If it lands "heads", the child gets their (the students') letter. If it lands "tails", then the child gets their spouse's letter. Have them write the "winning" letter down on the child's trait 1 line, and then ask what happened to the #1 gene from the parent that "lost". (it's gone, out for good; you could, though, bring up the fact that it's there "hiding" as a recessive gene).

- Move onto trait #2 for the child- its nose. The second coin flip will decide whose trait #2 gets passed on. Make sure you and your students catch that trait one is done, and we're now only comparing trait #2 from both parents. The red ovals and lines on the PowerPoint indicate this. The coin toss will decide which of those two "wins". After flipping the coin, record the letter for trait 2 of the child. Again, the losing trait it out of the game for good.\*<sup>5</sup>



- And the same for trait #3 (chin)- the third flit will decide whose trait #3 gets passed on.
- By now most students should be comfortable enough that they can finish "creating" their child by flipping the penny 7 more times. Go find students who don't seem to be catching onto this.
- After completing the child's 10 traits, fill in the percent of **your** DNA in the child at the end of the line. Remember, it's asking how much of your original DNA is present. It should be around 50%, but it will vary because there's no controlling a coin toss.

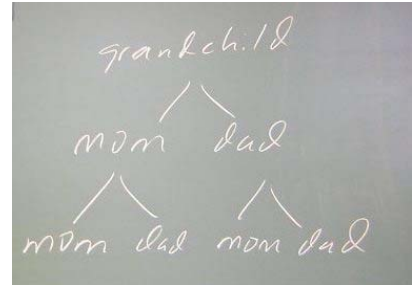
- Before moving on, ask if anyone has anything interesting to share. Strange things will have happened, like all 10 were tails, or the first 5 were heads and then the last 5 were tails. If someone got 8 heads and 2 tails, someone else in the room got a 2 and 8. The law of averages almost never fails.



- Decades pass, the child grows, they find a spouse (assign a new letter to this new person), then has your grandchild. The first coin flip decides which of the 2 trait

#1's gets passed on to the grandchild. *Again, compare trait 1 to trait 1 on the two parents involved, and 2 to 2, and so on.* Whichever traits the child gets, write it down, just like the first time around. For the rest of the activity, heads will refer to "your" side, and tails to the "spouse's".

16. Go through trait #2 with them, if needed. All of these people and letters might still be confusing them.
17. Turn them loose to finish the grandchild. Ask them to stop when they finish and record the percent of *their* original DNA made it into their grandchild- we're talking here about how many of the letters that represent them are still in their grandchild (it should be 20%-30%).
18. Walk up to the chalkboard, take a piece of chalk and announce that there is something amazing going on that is hard to explain, so you're going to just draw it. Write "grandchild" on the board, then, doing some out-loud thinking to yourself (and students). Conclude that this grandchild had a mom and dad, and each of them had a mom and dad. (This way of thinking is also preparing them for homework question #3):



“How many people’s DNA went into your grandchild? (4!) So, statistically, 25% of you should be in your grandchild. Now, you’ve always known that you had 4 grandparents, but you’ve probably never thought of it this way before.

There is some of your DNA is in your grandchild, right? But it’s mostly (75%) other people’s DNA. And that’s just after 2 generations. You’re being diluted out!

19. You can now pick up the pace as the cycle repeats itself. The grandchild gets a spouse (assign a new letter). Flip 10 times for your great-grandchild. Calculate the percent of your original DNA still hanging on.
20. Then one last time for the great-great-grandchild (you’re now 173 years old). A little stop sign appears in the lower-right corner of the PowerPoint to tell you that the next click goes to the homework slide.
21. The homework questions will reinforce the main topic- the accumulation of genetic differences over time. Questions 1 and 2 are self-explanatory. For #3 have them finish the chart as it shows, assigning a mom and dad to each mom and dad just for those 5 generations. For the answer, count how many different people there are on the Roman numeral 1 line.

**Accessories:** Other sub-topics you can add for more length and depth.

- \*<sup>1</sup> If your reading mentions “DNA”, “chromosomes” and “genes”, don’t forget how scary those words look to young people. Most of your students may not fully understand these terms yet, and we tend to be afraid of things we don’t understand. A ball of sting or yarn illustrates well all 3 terms. The ball is the chromosome. Unwind it a few feet- that’s the DNA. Pinch a section of string between your hands- that’s a gene.
- \*<sup>2</sup> Humans have between 30,000 – 40,000 genes!
- \*<sup>3</sup> Many state science standards want students to know the difference between inherited traits and acquired skills. What better time to ask than now? -  
 “Students, I’ve got a tough question for you- can you give me an example of something about you that is *not* caused by your DNA? (silence.....) Ok, what if at the hospital where you were born, you were accidentally switched and went home with another set of parents. How would you be different?”
- \*<sup>4</sup> After the class has flipped their coins once, count how many students are in the classroom and divide that number in half. Ask those who got “heads” to raise their hands. Sure enough, half of the class, or number very close to it, will raise their hands. Some will observe this and think you’re a psychic.
- \*<sup>5</sup> Ask the class if they want to see a magic trick. Add up how many people there are in class and divide it by 4. Announce that you are about to ask 4 questions, and ¼ of the class will raise their hands in response to each one. Question 1. “How many of you have, so far, gotten both traits for yourself passed on?” (about ¼ of the hands raise). 2. “Who has trait one for you, and trait two for spouse?” 3. “Trait one is spouses, and trait two is yours?” 4. “Both are your spouse’s”.

Come back and visit [InteractiveScienceTeacher.com](http://InteractiveScienceTeacher.com) to upgrade this lesson with:

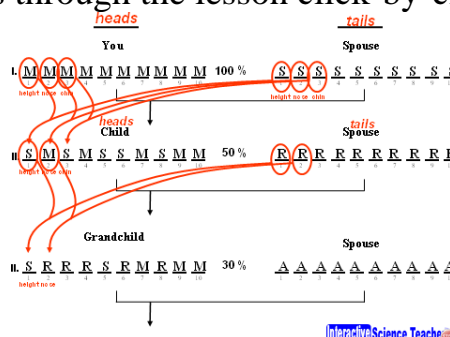
**PowerPoint-** lead your students through the lesson click-by-click



- a child inherits its genes from both parents
- typically, half of the genes come from each parent
- this activity shows how genetic differences accumulate over generations

Let's read, starting on p.

[InteractiveScienceTeacher.com](http://InteractiveScienceTeacher.com)



**MEASUREMENTS - ESTIMATING YOUR DNA**

- Record the percent of your DNA percent in each generation:  
 I. \_\_\_\_\_ % (You)  
 II. \_\_\_\_\_ %  
 III. \_\_\_\_\_ %  
 IV. \_\_\_\_\_ %  
 V. \_\_\_\_\_ %
- Compare the DNA of your child with that of your grandchild:  
 Child: \_\_\_\_\_ %  
 Grandchild: \_\_\_\_\_ %  
 Comment: \_\_\_\_\_
- Beginning with your original grandchild and working backward: If you knowingly told people (including parents and siblings) of your sex, how many people would be able to trace their DNA back to you? \_\_\_\_\_ people!

Close Your Grandchild

```

  I. You
  II. You
  III. You
  IV. You
  V. You
  
```

[InteractiveScienceTeacher.com](http://InteractiveScienceTeacher.com)

