Make a model DNA strand

Summary

A strand of DNA looks like a ladder that has been twisted into a corkscrew. Just like a ladder, a DNA strand has two rails running parallel to each other and rungs that connect the rails.

The rails of the DNA strand are made up of ***deoxyribose*** (a sugar) and ***phosphoric acid***. These two molecules alternate one after the other the entire length of the rail.

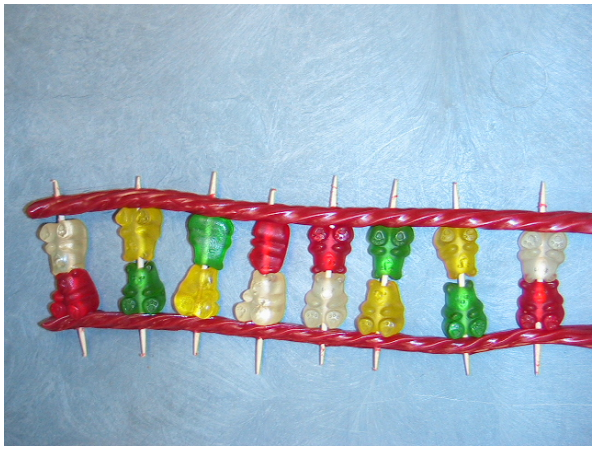
The rungs of the DNA strand are made up of ***organic*** *bases*. These organic bases attach to the deoxyribose on the ladder rails. The four bases that make up DNA are Adenine, Thymine, Cytosine, and Guanine. These bases are abbreviated as A, T, C, and G. Each rung of a DNA strand contains two bases that are paired together. Each base has a specific partner that it pairs with. Adenine always pairs with Thymine and Cytosine always pairs with Guanine. (Remember AT and CG).

In this activity, you will build two DNA models. Both models represent the major components of a strand DNA.

In this activity we will:

- Build a model DNA strand.
- Analyze the model to see what each of the components represents.
- Analyze the model to see what properties of actual DNA are not represented

Model #1 (Candy Model)



Materials (Model #1)

- 2 pieces of regular Twizzlers
- 1 bag of medium Gummy Bears

- 1 box of round toothpicks

Safety

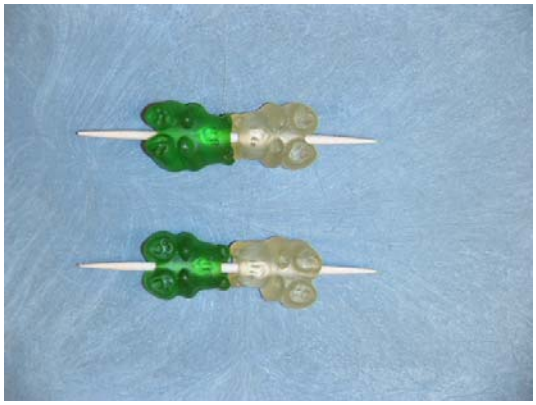
This activity requires the use of sharp toothpicks. Use caution when working with the toothpicks. These toothpicks can puncture your skin if not handled properly. Ask an adult to help you if necessary.

Preparation

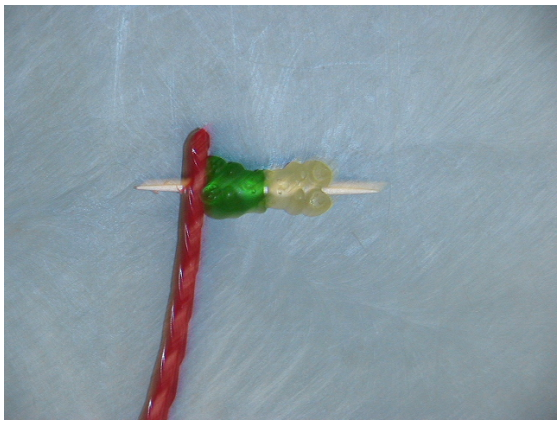
- Gather all materials listed above before beginning

Activity

- Take out four red, four clear, four yellow, and four green Gummy Bears.
- Carefully thread a green and clear Gummy Bear onto a toothpick. (Be careful to not poke your fingers while doing this). The Gummy Bears should touch each other and meet in the middle of the toothpick leaving extra space on either side of the toothpick.

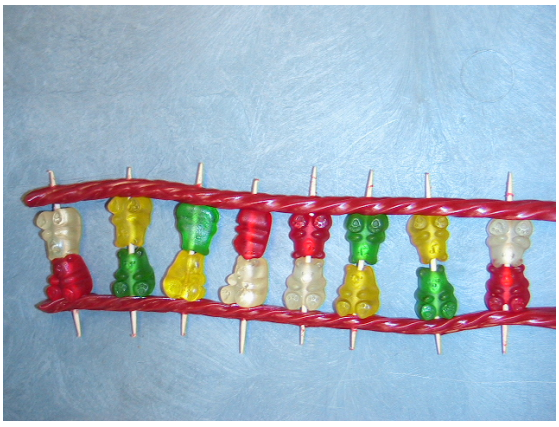


- Continue to thread one green Gummy Bear with one clear Gummy Bear until all green and clear colors are paired.
- Thread the red Gummy Bears with the yellow Gummy Bears the same way that you did with the green and clear. You should now have 8 pairs of Gummy Bears threaded onto toothpicks.
- Take the one pair of Gummy Bears and press one end of the toothpick into a strand of Twizzlers. It does not matter which toothpick is used.



- Take the remaining pairs of Gummy Bears and stick them into the strand of Twizzlers as done in the previous step. Leave about one inch in between each pair of Gummy Bears.

- Connect a second strand of Twizzlers to the other end of the toothpicks.



- You should now have a ladder with eight rungs.

Wrap-up

Remember that DNA is shaped like a corkscrew. To get this shape, twist the model that you made to get a better idea of what DNA looks like. The shape that you just made is referred to as a double helix.

Each Gummy Bear in the model represents a base. The Green represents Guanine and the Clear represents Cytosine. What two bases do the other two colors represent?

This model is missing a component. Which component is missing? Read through the summary if you need help with this question. (Answer is at the end of this activity).

Model #2 (Pipe Cleaner Model)

Materials (Model #2)

- 1 small box of wagon wheel pasta
- 1 small box of ziti pasta
- Approx. 3 feet of string
- 4 different colors of pipe cleaners (2 lengths of each type)
- Scissors
- Ruler
- Markers (Optional)

Safety

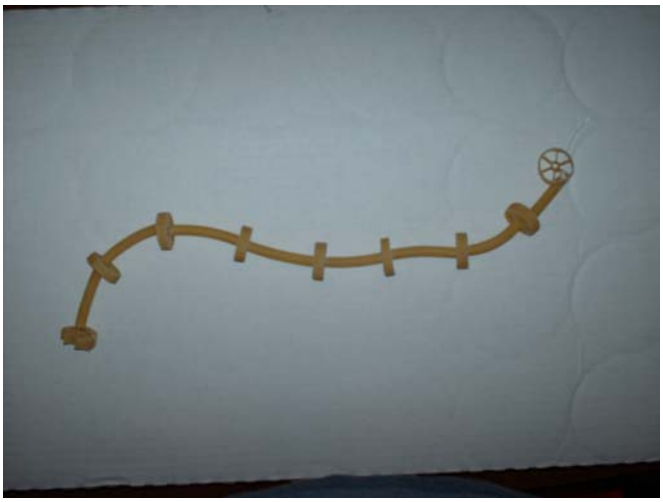
This portion of the activity requires the use of sharp cutting tools. Use caution when handling knives or scissors. Ask an adult to help you if necessary.

Preparation

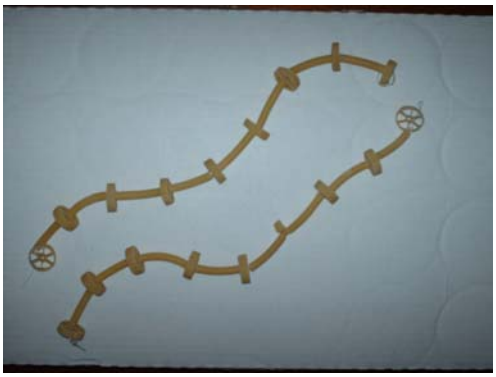
- Gather all materials listed above before beginning

Activity

- Cut a piece of string about 24 inches long.
- Tie a piece of wagon wheel pasta to one end of the string through the middle of the piece of pasta.
- Add a piece of ziti pasta onto the string next followed by another piece of wagon wheel pasta. Continue to add the pasta alternating the type each time until you have at least 9 pieces of wagon wheels. Tie the string to the last piece of wagon wheel pasta through the middle of the piece of pasta.

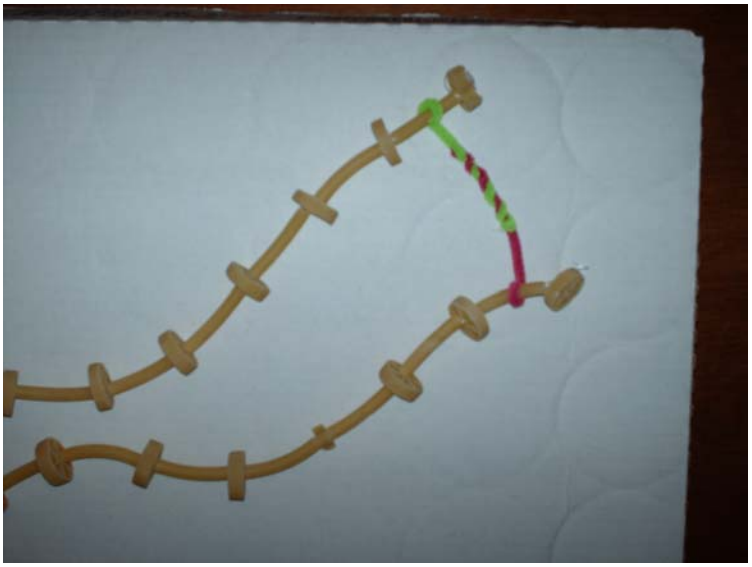


- Make another string of ziti and wagon wheel pasta like you did before.

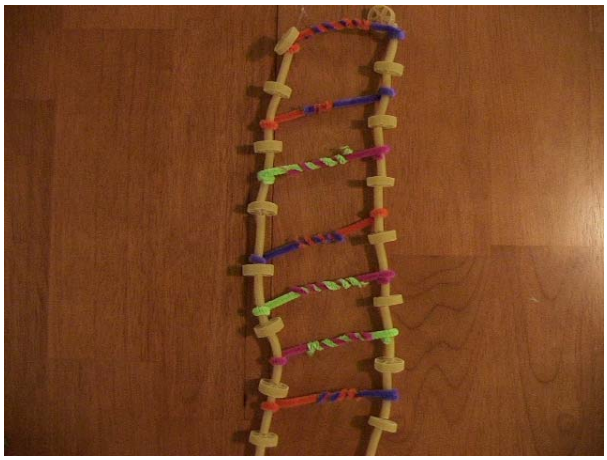


- Cut the pipe cleaners into pieces 4 inches long. Cut 4 pieces of each color.
- Twist the ends of two different colors of pipe cleaners together. Repeat this so that you have a total of eight pairs of pipe cleaners. **Be sure to pair the same colors of pipe cleaners each time. (Only four of the 8 pairs are pictured)**

- Take one pair of pipe cleaners and attach one end of this pipe cleaner to a piece of ziti and the other end to the same piece of ziti on the other strand of pasta.



- Perform the same step with the remaining pairs of pipe cleaners so that you build a ladder that looks like the picture below. The rungs of the ladder do not need to be in any particular order.



- You can now color the wagon wheels and the ziti with paint if you would prefer.

Wrap-up

This model represents all three main components of DNA including ***deoxyribose***, ***phosphoric acid***, and ***organic*** *bases.* Can you identify these three components in your model? Why was it so important to pair the same colors of pipe cleaners each time?

Answers

Model #1: This model does not show the two individual components that make up the rails of the DNA strand. Remember that the rails of a DNA strand contain repeating molecules of ***deoxyribose*** (a sugar) and ***phosphoric acid***.

Model#2: The alternating wagon wheel and ziti pasta represent the ***deoxyribose*** and ***phosphoric acid*** molecules. The pipe cleaners represent the four bases. Remember that Adenine always pairs with Thymine and Cytosine always pairs with Guanine. That is why it was so important to pair the same colors each time.

Resources

http://nobel.scas.bcit.ca/resource/dna/dna_sweets.htm
http://school.discovery.com/lessonplans/programs/modeldna
http://learn.genetics.utah.edu/units/basics/builddna/ (Great Animation Site)