iSTEAM After School

LESSON 11: DNA CREATORS

Students will learn about DNA and how spies use DNA, while creating their own DNA model.

SUPPLIES

TEACHER BRINGS

- 24 Twizzlers
- 150 Dots of four different colors

SUPER SPY SUPPLIES

- 80 Toothpicks

FOLDER

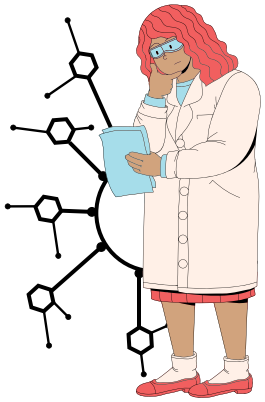
- Multi Colored Paper (30)

PENCIL BOX

- Pencils (15)
- Scissors (12)
- Scotch tape (4)
- Markers
- Glue sticks (6)
- Scotch Tape

MEET SPECIAL AGENT

HELIX



Specialty: Forensic Science

Dr. Helix, known by her code name Helix, is a brilliant DNA expert and a vital member of the spy team. With her extensive knowledge of genetics and forensic analysis, she plays a crucial role in extracting and deciphering valuable information from DNA samples found at crime scenes or in intelligence operations.

OBJECTIVES

- [x] To understand what DNA is and how it is used by spies.
- [x] To make my own DNA model using candy.

HOOK

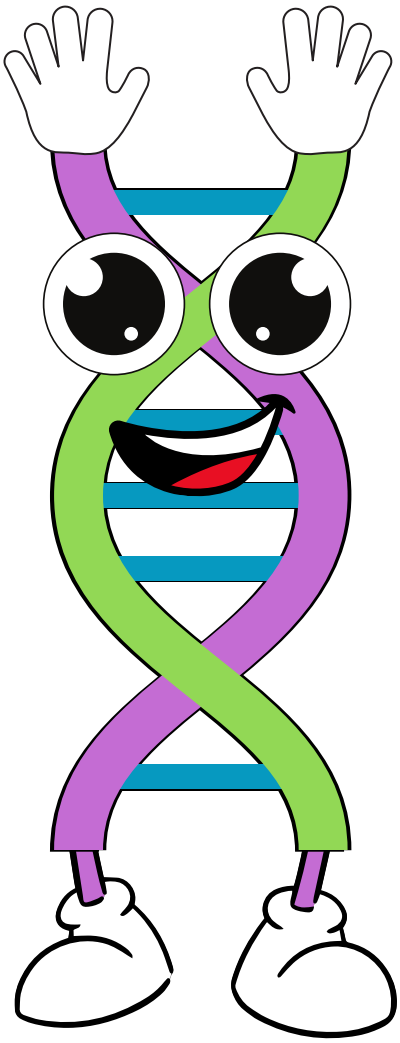
3-5 min

- Detectives look carefully at a crime scene or mystery. They look for clues, big and small.
- Some of the smallest clues can be the most important!
- How could a person's hair be a clue for a spy?
- Let students offer their thoughts and ideas. Explain that we all have a unique code, called DNA which spies can use to find out who was at a crime scene.

LESSON 11: DNA CREATORS

DISCUSSION

5-7 min

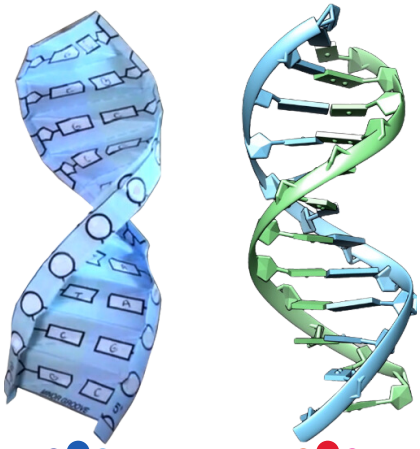


DNA stands for deoxyribonucleic acid. DNA is a long, thin molecule that has a specific code that is unique for each one of us. Our DNA helps tell our bodies how to function and develop, like a computer program!

DNA has a specific shape called a double helix. Each part of the double helix looks like long, thin strands. The strands contain a specific code of molecules called nucleotides. There are four different types of nucleotides - Adenine, Thymine, Cytosine, and Guanine. The arrangement of the nucleotides in the double helix are what gives us each our unique code. Adenine and Thymine are always paired together. Cytosine and Guanine are always paired together.

If you unraveled the DNA in your body, it would stretch to the sun and back many times! DNA is such a long chain, that it is similar in most people. Humans DNA is 99.9% the same. The 0.1% is what gives us our unique code.

Our unique DNA can be used to identify us. DNA can be found on our hair, in our fingernails and in our skin. Spies look around a crime scene for any small clues that would contain DNA. They can then take this sample to a lab to have the specific DNA identified. This helps to find out who was at the crime scene, which can help them find the suspect!



HYPOTHESIS

3-5 min

Show students the supplies and tell them that they will be making a DNA model. Ask them to predict:

- What will each supply be used to represent?
- Will your DNA model be the same as other people in your class?

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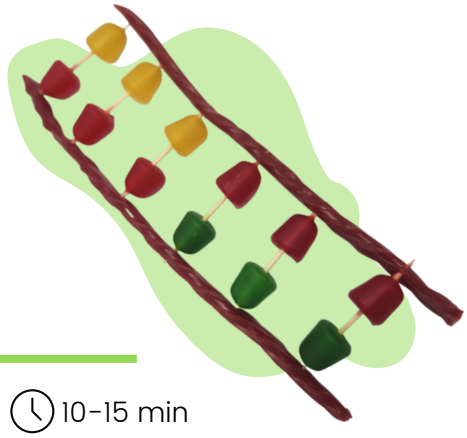
ACTIVITY PART 1

10-15 min

1. Give each student two Twizzlers, six toothpicks and twelve dots (3 of each color).
2. Ask students to decide as a class what nucleotide each color stands for.
3. Then, have students thread two dots onto each toothpick.
4. Attach the toothpicks to the Twizzlers with equal spacing. It should look like a ladder.
   - Remember, Adenine and Thymine are always paired together.
   - Cytosine and Guanine are always paired together.
5. At this point, have students write out the genetic code. To do this, they will need to record the nucleotide letter associated with each color (i.e., A -red, T-yellow, C-orange, G-green).
6. Finally, remind students to that DNA is a double helix, so their model needs a twist! Have them hold one end still while twisting the other end 180 degrees. Their DNA model should now be complete!



ACTIVITY PART 2

10-15 min

Challenge students to make another DNA model out of paper. Provide students with 4 different colors of paper. Make sure to pass out rulers, Scotch tape, and masking tape to groups

1. Have students cut their paper into 1cm x 4cm long strips. They will not need to use a full sheet of each color of paper (consider grouping students into four and giving each member one color sheet, then having them cut enough of that color for the full group)
2. Students will now pair up 2 colors and connect them with scotch tape or glue sticks
   a. Pair the other 2 colors together and do the same thing
   b. Repeat this multiple times so you have a bunch of connected strips

3. Have students lay out 2 strips of masking tape (12 inches or longer) next to each other
   a. Make sure the sticky side is facing up
   b. They can flip a small bit of each edge to stick to the tables to hold the tape down!
4. Now, have students start attaching the the color paired strips to their 12inch strips of masking tape.
5. Once they have done so in whatever pattern they choose have the students lift up their tape and do a slight twist to their whole design.

They will have now completed their very own unique double helix

OBSERVATION & EXPLANATION

5-7 min

Ask students to compare their DNA codes.

- How were they similar?
- How were they different?
- Were any the same? Why do you think this was.

Explain that students models look similar because they all have the same structure and materials. What differs is the order of the colors (nucleotides) in their model. Many students will have had similar rows of nucleotides but the entire model wasn't exactly the same. This is similar to how our DNA is very closely related but the small differences create our unique DNA, that can help identify us.

If any students have models that are EXACTLY the same, discuss why this could have happened. Remind students that DNA strands are very long and we have made a short model. This means there is a greater chance of the models being EXACTLY the same, while in longer DNA strands, the codes have more opportunities to vary.

CONCLUSION

5 min

Complete Exit Ticket Activity. Then, instruct students to clean their stations. Make sure to leave the classroom the way you found it.

Exit Ticket

Ask each student one of the following questions as they walk out the door.

- Why do spies use DNA? (To identify suspects)
- What can DNA be found on? (Skin, hair, nails)
- How many different nucleotides are in DNA? (4)
- What does DNA do in our bodies? (Tell our bodies how to function and develop)
- What shape is DNA? (Double helix)