DNA	Grade 8 Biology

Lesson Plan

Safety Notes

Be careful when using rubbing alcohol. Adult supervision is recommended.

Description

In this lesson, students will identify DNA in the nucleus. Cells are the basic unit of life. All cells come from pre-existing cells with the nucleus holding all of the information needed to make every cell in the body. Students will also explore genetic phenology in fingerprint patterns.

Materials

Fingerprints:

- Carbon tip pencil, washable markers or ink pad
- Piece of paper
- Your fingers

Strawberry DNA:

- 1 tbsp rubbing (isopropyl) alcohol 70%
- 3 clear cups or small bowls
- ⅓ cup water
- 2 tsp dish soap
- ½ tsp salt
- 1 strawberry (frozen or fresh)
- Small wire strainer, paper towel or coffee filter
- Toothpick
- Fork

Science Background

Each cell has different organelles needed to carry out different functions. The nucleus within a cell contains all of the information needed to make every cell in the body, with the help of one very important molecule...DNA.

DNA (DeoxyriboNucleic Acid) is a molecule with many atoms formed together that coil around each to make a double helix shape (see diagram below). This chain carries genetic instructions within every cell's nucleus. The DNA code determines everything about living things - including you. Your DNA determines the colour of your hair, your height and even if you can cross your eyes or not! To understand DNA, we must understand amino acids.

Amino Acids are very important and are considered the building blocks of life. There are approximately 20 different kinds of amino acids (think of them as legos, some are different

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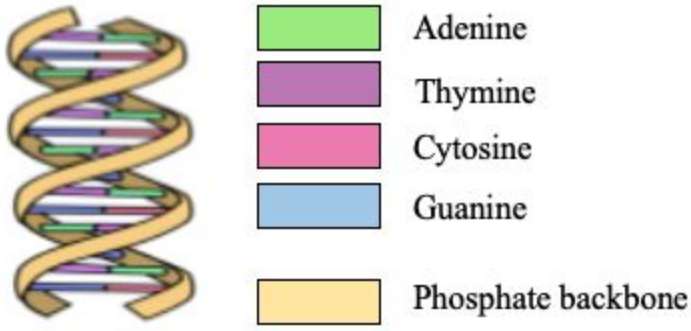
colours but they can connect together to make anything). When amino acids come together they make proteins, which makes cells, cells make tissues and organs and finally, a living organism like a cat or a tree or a dinosaur.

How do amino acids and protein relate to DNA?
One of the main functions of DNA is instructing amino acids how to form proteins. The protein it creates then controls various functions.

The outside "ladder" of a DNA helix is made of a special sugar **phosphate backbone** while the inside is made from four different **bases**. There are four types of DNA bases which create base pairs. Base pairs mean that only certain bases can pair together and fit together like a puzzle piece. The four different bases and their pairs are:

- Adenine → Thymine
- Guanine → Cytosine



Your body reads this DNA code like a sentence in a book. In the same way that you can write hundreds of different words using the same 26 alphabet letters, there are endless DNA code sentences using the four base pair combinations. Each word is 3 letters which are the recipe to make amino acid. DNA strands are very long and remain coiled up in the nucleus of a cell. The amino acids, however, live outside of the nucleus. In order for the amino acids to get the DNA to make proteins, the DNA will copy sections which we call **RNA**.

RNA (RiboNucleic Acid) is a smaller copy of DNA. Because they are smaller sections, the RNA can fit through pores and get out of the nucleus. The amino acids will then use it to make protein.

How does DNA make up all living things?

- The DNA makes copies of itself called RNA → the RNA is used to make amino acids → the amino acids come together to make proteins → proteins make cells → cells make tissues → and tissues make up all living things**.**

If DNA is always being replicated, why do people or even siblings have different physical traits?

- Variations in DNA are responsible for this. These variations will change how a living thing looks and develops. A set of DNA instructions is called a **genome**. Within a genome, there are

trillions of DNA letters that are divided into something called **chromosomes**. Every human has 46 chromosomes, 23 are from your father and 23 are from your mother.

- When you get the chromosomes from your father and mother, you only get half of their genes which can be any of their 46 chromosomes. This is why siblings can look very different.
- As humans, we all share the same genes. Actually, all humans are 99.9% genetically alike. Only 0.1% makes us different. What makes us different is that we have different versions and combinations of the same genes.

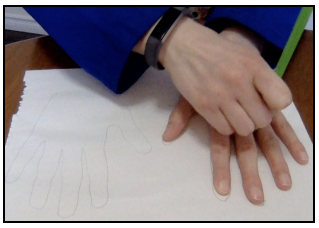
Fun Fact: Humans share 98.7% of their DNA with Chimpanzees, share 85% of our DNA with mice, 40% of our DNA with fruit flies and 41% of our DNA with bananas.

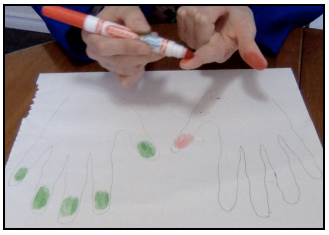
Fingerprints: are often genetically inherited, but the individual details that make a fingerprint are not. Their shape and pattern depends partly on genetics and partly on random events that might happen in the womb during development. This means that no two fingerprints are alike - even identical twins! Although they might share the same DNA, their hormone levels, length of the umbilical cord and food consumption differ. These can cause different patterns of fingerprints to form. Fingerprints are divided into three categories based on their pattern:

- **Whorls:** includes ridge patterns that are generally rounded or circular in shape (35% of people have whorl fingerprints)
- **Loops:** characterized by ridgelines that enter from one side of the patter and curve around to exit from the same side of the pattern (65% of people have loop fingerprints)
- **Arches**: characterized by ridgelines that enter the print from one side and flow out to the other side (5% of people have arch fingerprints)

Activity Procedure: Fingerprinting

1. Trace both of your hands onto a sheet of paper and label them left and right
2. With your thumb on your right hand, colour just the pad of your finger
3. Press your finger onto the outline that matches
4. Continue this until all of your fingers have been printed and the all of the patterns appear on your outline
5. Now it's time to be a detective and explore what kind of fingerprint patterns you have (whorl, loop or arch)





Activity Procedure: Strawberry DNA

Preparing Extraction Mixture:

1. Place a bottle of isopropyl alcohol in the freezer (It will not freeze solid but having a very cold mixture works best)
2. Pour 1/3 cup of water into a cup or bowl
3. Add 2 tsp of dish soap to the water
4. Stir in a 1/2 tsp of salt and mix until the salt dissolves, careful to not create too many bubbles

Preparing the Strawberry:

1. Place one strawberry (frozen or fresh) into the other cup or bowl.
2. Put the strawberry in the microwave for a few seconds until it is very soft
3. Once the strawberry is out of the microwave, use the fork or your hands to mash the strawberry
4. Pour the extraction mixture into the cup or bowl with the strawberry
5. Mix it all together, try and create the least amount of bubbles as possible

DNA Extraction:

1. Place a small strainer, paper towel or coffee filter on top of a last cup or bowl. This cup or bowl should be clear in order to see the DNA.
2. Pour the strawberry mixture into the strainer (you want to get as much of the liquid in the cup or bowl but the least amount of strawberry pieces)
3. Take the isopropyl alcohol out of the freezer and pour 1 tbsp into the strawberry mixture (make sure to pour **slowly** so that the cold alcohol sits on top of the strawberry mixture)
4. Let the mixture sit for a few minutes
5. Slowly, you will begin to see DNA strands floating to the top
6. With a toothpick try to pick up the small strands of DNA!



Complete questions 1-4 on the handout.

Debrief

DNA genetics are important to understanding humans as well as all living things on our planet. Every nucleus within all cells contains the special instructions that make up every living organism. Only a small percentage of human DNA is required to make us unique.

Handout

1. Outline your hands on a piece of paper and use ink to create your fingerprints. Use your fingerprints to fill in the table below. You can also compare your fingerprints with a family member's, are they similar?

Whorl pattern Loop pattern Arch pattern

Left Right

Left Hand Fingers:	**Type of Fingerprint:** (Whorl, loop, arch)	**Right Hand Fingers:**	**Type of Fingerprint:** (Whorl, loop, arch)
Left finger #1:		Right Finger #1:	
Left Finger #2:		Right Finger #2:	
Left Finger #3:		Right Finger #3:	
Left Finger #4:		Right Finger #4:	
Left Finger #5:		Right Finger #5:	

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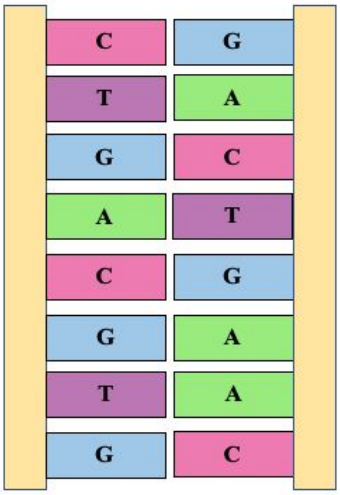
2. Match the base pairs by drawing a line to the matching pair below:

Adenine	Cytosine
Guanine	Thymine

3. Circle the 'mutation' (improper matching of base pairs) in the genetic code below:



4. Complete the multiple choice below:

What affects the shape of your fingerprints?
   a. Genetics
   b. Nothing it is just random
   c. Environmental factors in the womb
   d. Both a and c

What is the rarest type of fingerprint?
   a. Whorl
   b. Loop
   c. Arch
   d. They are all equally as common

What part of the cell holds <u>most</u> of the DNA?
   a. Mitochondria
   b. Vacuole
   c. Nucleus
   d. Cytoplasm

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Handout (Answer Key)

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Left Finger #3:		Right Finger #3:	
Left Finger #4:		Right Finger #4:	
Left Finger #5:		Right Finger #5:	

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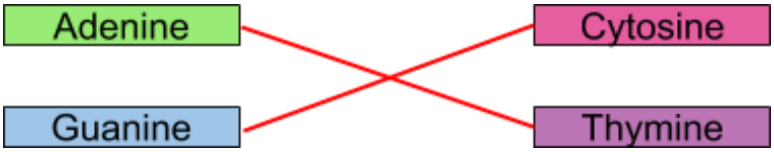

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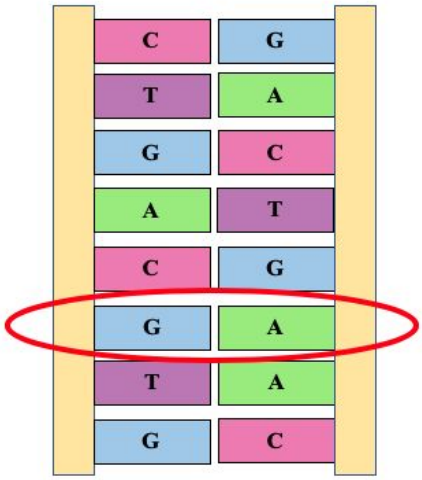

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