DNA and Identity

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Using DNA

Why is one person's hair black, another's red and another's blonde? Why is someone over seven feet tall and other individuals under five feet tall? Why do some people have blue eyes, some people green, and others brown?

The answers to all of the above questions lie in the information we find in DNA (Deoxyribonucleic Acid). The DNA of a person is found in the nucleus of a cell and is a very, very long stringy like substance that is made of four organic compounds. These four organic compounds are called, adenine, cytosine, guanine, and thymine. These four compounds make up sequences that provide a map for the body that gives it all matter's of instructions. Adenine is only able to pair with thymine while cytosine is only able to pair with guanine. These combinations of the four compounds are almost endless and account for the many traits we exhibit.

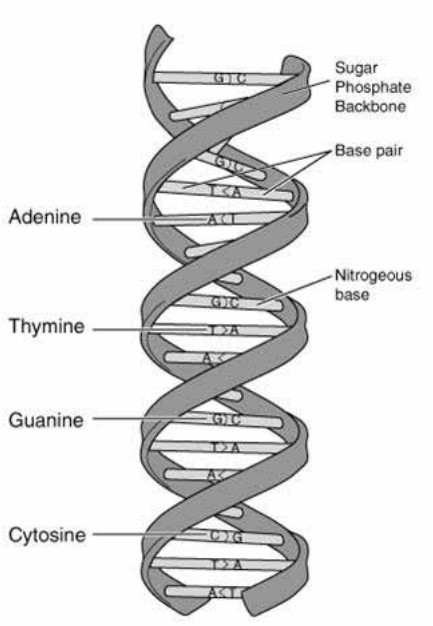
You may have heard in the news of people who were convicted of violent crimes based on circumstantial evidence who were released after 10 to 15 years in prison. This is almost always based on DNA evidence found at the crime scene. Improvements in forensic science allow for more accurate identification of DNA with smaller samples. More than 232 wrongfully imprisoned people have been declared innocent based onreexamination of DNA.

The chemical structure of everyone's DNA is the same. The only difference between people (or any animal) is the order of the base pairs. There are so many millions of base pairs in each person's DNA that every person has a different sequence.

Using these sequences, every person could be identified solely by the sequence of their base pairs. However, because there are so many millions of base pairs, the task would be very time-consuming. Instead, scientists are able to use a shorter method, because of repeating patterns in DNA.

These patterns do not, however, give an individual "fingerprint" but they are able to determine whether two DNA samples are from the same person, related people, or non-related people. Scientists use a small number of sequences of DNA that are known to vary among individuals a great deal, and analyze those to get a certain probability of a match.

A Model of DNA



MOST*

VOCABULARY

Adenine

Cytosine

Deoxyribonucleic acid

Guanine

Thymine

Inside This Packet

New York State Standards

Middle School

Standard 4:
Process skills
Use of graduated cylinder
Use appropriate units for measurement
Key Idea 1: 1.1a, 1.1b, 1.1c, 1.1d, 1.1e, 1.2i
Key Idea 2: 2.1a, 2.1b, 2.1c, 2.1e, 2.2a, 2.2b, 2.2c

Activity: Strawberry DNA

MATERIALS NEEDED

Fresh strawberries
Ziploc bags
Fork
Liquid dish soap
Salt
Teaspoon
Coffee filter
Small glass bowl
Graduated cylinder, small
Rubbing Alcohol (91%)
Stirrer
Magnifying Lens

Students should be able to:

Extract DNA from a strawberry.

Discuss the uses for DNA.

You will be extracting DNA from a strawberry and looking at it's structure.

Step 1:
Place one large or two small strawberries in a Ziploc bag. Use the fork to mash thoroughly until it is pulp. Be careful not to put a hole in the bag. Add one drop of soap, a pinch of salt and four teaspoons of water. Mix gently. Let it sit for five minutes. Use this time to start answering the question sheet.

Step 2:
Pour the mixture through a wet coffee filter into a small glass bottle. Filtering will take about five minutes.

Step 3:
Remove filter and slowly pour about 15mls of very cold 91% alcohol carefully down the sides of the glass to form a separate layer on top. (Don't stir!)
Caution: The rubbing alcohol is poisonous. Wear goggles!

Step 4:
Watch until a white glob forms at the interface. This glob is DNA.

Step 5:
Use the stirrer to gather up some DNA strands. Examine more closely with a magnifying lens.

Activity: Strawberry DNA

*Name:*_____ *Date:*_____

1. Draw what you saw under the magnifying lens.

2. What is DNA?

_____

_____

_____

_____

3. For the following sequence, write the appropriate matching pair contained in the DNA strand.

A	C	G	G	T	A	A	C	T	G
__	__	__	__	__	__	__	__	__	__

4. What did you find surprising in this lab activity?

_____

_____

_____

_____

_____

_____

_____

_____

What happens during extraction?

Step 1:
The lipid or fat layer of the cell membrane and nuclear membrane are broken down by the soap. EDTA in soap binds to Magnesium ions preventing DNA nuclease from breaking down DNA molecules. The positively charged sodium in salt is attracted to the negative charge of DNA creating a shield and causing them to stick together.

Step 2:
Filtering separates out extra cell debris (cell membranes, precipitated proteins and excess fruit pieces) DNA molecules are soluble in water and pass through the filter.

Step 3:
DNA molecules are soluble in water, but not in alcohol. The alcohol precipitates out the long stringy DNA molecules. (DNA is colorless. Any color you see would be fruit pigment molecules that were trapped.)

Source Material

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