**Activity Using STRs to Identify Victim of 911**

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**Scenario**

 A warm breeze flowed into my sunny biology classroom on the early morning of September 11, 2001. Shortly after 8:46 AM a frantic fellow teacher ran into my room stating that the North Tower of the World Trade Center, the tallest building in NYC had been struck by an airplane. I turned on the television and we watched in horror as the black, billowing smoke and intense heat spewed out of the upper story windows. At 9:03 we witnessed a second plane crash into the South Tower of the World Trade Center.

We later learned that four different commercial airplanes had been hijacked by nineteen members of the Al-Qaeda. This was done as an act of terrorism directed towards the United States. Initially it was thought that 3,000 people died as a result of the September 11th attacks including people working at the World Trade Center, the Pentagon, fireman, policeman, first responders, airline passengers and hijackers. Later estimates attribute over 6000 deaths resulting from the initial attack or subsequent illnesses due to the inhalation of toxic dust and fumes.

 Because of the intense heat, explosion and ultimate collapse of the World Trade Center buildings, identification of remains was very difficult. Only one thousand six hundred and thirty one remains have been identified by DNA analysis.

 A student whose father had died in the World Trade Center bombings, brought to school a graph (electropherogram) used to determine if the remains found near the World Trade Center could have been his father’s remains. The student had no idea of what the graph represented and asked for help in understanding the information.

 The student asked if I could explain how this test was done and to determine if the results of the test confirmed the identity of his father. The names have been removed from the graph to protect his and his family’s privacy. The student requested that I keep the graph and use it to educate others to show how some of the victims of 911 were identified using DNA.

 There are over 1,122 remains from 911 that have not yet been identified. It is hoped with advances in DNA, that someday it will be possible to bring closure to those families who lost loved one in this terrible attack.

 **Objectives:**

At the end of this activity, you will be able to:

1. Distinguish between a gene and an allele.

2. Distinguish between introns and exons.

3. Define, describe and provide an example of an STR.

4. Compare and contrast the different allelic forms of STRs.

5. Given the electopherogram or STR profiles of a mother and her two sons, to be able to analyze the STR profiles and provide evidence that the unknown person is the biological father.

**Procedure**

 *Refer to the electropherogram. The first line of DNA is from the mother. The third and fourth lines of DNA are from her two sons. The second line of DNA is from the DNA recovered from the 911 site.*

 *In this activity, you are to use the information found on the electropherogram to determine if the DNA recovered from the 911 site on line 2 could have be the father of this woman’s two sons.*

**Part 1**

1. Distribute the electropherogram to each student.

* On the left side, label the source of DNA for all four DNA samples:

 Top line 1 **Mother**

 Second line **Unknown DNA**

 Third line **Son # 1**

 Fourth line **Son # 2**

* What evidence is there on the electropherogram that the top line of DNA belongs to the mother and that the DNA found on lines 2,3, and 4 belong to males? Explain your answer.

2. Examine the electropherogram. Besides sex determination, how many other STRs were used to help identify each person?

3. Refer to line 2, the DNA recovered from the 911 site. Note that the genotype for the first STR is is (15,16). The second STR genotype is (12).The third STR is (17). The fourth STR genotype is (20,24).

* Provide an explanation why some STR genotypes are listed as a single number whereas other STR genotypes are listed as two numbers?

4. Refer to the fourth line of DNA, the DNA belonging to son # 2. Note the genotype of the first STR is (14,15).

* Which one of the alleles 14 or 15 came from the mother? Explain your answer.
* On the fourth line, Circle the allele in red that came from the mother.

5. If the second line represents the DNA recovered from the 911 site. Is it possible that this man could have contributed the other allele found in the son’s first STR?

* If it’s possible this man could have contributed the other allele, circle the son’s allele in blue that could have come from the unknown DNA
* If it is not possible, do not circle anything in blue.

6. Refer to the fourth line of DNA belonging to one of the two sons. Examine the genotype for the second STR for this son (11,12)

* Which allele 11 or 12 came from the mother? Explain your answer. On the fourth line, circle the allele in red that allele that came from the mother.

7. Is it possible that this man (from line 2) could have contributed the other allele found in the second STR?

* If it is possible, then circle in blue the son’s allele that was contributed from the DNA found on the second line.

8. Continue to examine the rest of the STRs of the fourth son in the same manner as you did for steps 4-6 and circle the mother’s contribution in red and the unknown DNA contribution in blue.

9. Based on your examination of all the STRs and the evidence found on the electropherogram, could the DNA recovered at the 911 site (line 2) be the father of the son (line 4) and the mother (line 1)? Justify your statement using evidence from the electropherogram.

**Part 2**

10. Refer to line 3, the electropherogram of the son # 1. Repeat the same process and circle the son’s alleles that came from the mother in red and circle in blue the allele that comes from the unknown DNA (line 2).

11. Based on your DNA analysis, could the DNA recovered at the 911 site (line 2) be the father of the son (line 3) and the mother (line 1)? Justify your statement using evidence from the electropherogram.

12. Suppose that only 3 different STRs were used to examine all the persons DNA and that all three STRs were consistent with this man being the father of these two sons with this mother. Could you confirm that the remains did belong to their father?

13. Using the information from the electropherogram for the mother(line 1) and the unknown DNA on line 2, write a possible genotypes for a third child, a daughter using probes 4 and 5.