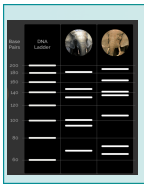

Click and Learn
CSI Wildlife

hhmi | BioInteractive

Student Worksheet

ABOUT THIS WORKSHEET

This worksheet complements the Click and Learn "CSI Wildlife." (http://www.hhmi.org/biointeractive/csi-wildlife).

PROCEDURE

As you proceed through the interactive, follow the instructions and answer the questions in the space provided.

1. ***Read the introduction and watch the opening video.***
   a. What is a keystone species?

   b. Dr. Wasser states that approximately 50,000 African elephants are killed each year. According to the video, it is estimated that there are around 470,000 African elephants. If these numbers are correct, approximately what percentage of African elephants are killed each year? (Show your work.)

   c. In one or two sentences, summarize Dr. Wasser's research and how it is being used to conserve elephants.

CASE ONE:

2. ***Watch the crime scene video on the first slide of Case One.*** Explain the goal of the case.

3. Look at the map provided and list the region or countries the majority of African elephants inhabit.

Proceed to the ***How DNA Profiling Works*** section.

4. What does "**STR**" stand for?

5. **Look at the gel on the screen.** What do the bands on the gel represent?

6. STRs at specific loci have shared characteristics between individuals and/or alleles. Place a check next to the characteristic(s) that are shared.

☐	Made up of nucleotides	☐	Unit, i.e., CTA
☐	Flanking sequence	☐	Same number of units

7. DNA profiling is also called DNA fingerprinting. A common misconception about DNA fingerprinting is that the analysis has to do with actual fingerprints. Explain one similarity and one difference between a human being's pattern of bands on an electrophoresis gel and a human fingerprint.

8. ***Click on Technique***. List three sources to obtain elephant DNA for analysis.

9. ***Watch the animation on the polymerase chain reaction under Technique.*** Why are flanking sequences important for amplifying STR fragments?

10. A scientist makes primers specific to a particular STR fragment in elephants. These primers are then used to amplify the STR fragment from 10 different elephants. Would you expect the fragment to be the same size in all the elephants? Explain your answer.

11. Scientists typically amplify multiple STR fragments from an individual in a single PCR. Explain how they are able to do that.

12. What is the relationship between the size of a DNA fragment and the distance it migrates in the gel?

13. Why does DNA migrate to the positive electrode?

14. Run the gel in the ***Technique*** section by pressing the **Start** button. Which elephant (left or right) has both the largest and smallest fragments? _____ Approximately what size is the largest fragment (bp)? _____ Smallest? _____.

15. Proceed to the ***Application*** section and look at the gel. For Marker C, are the two elephants in the gel on the left homozygous or heterozygous? How do you know?

16. These two elephants come from two different populations that are geographically distant from one another. If the gel were to show data from two elephants that were siblings, would their profiles be more or less similar? Why?

17. Why do you think scientists use multiple markers to identify individual elephants?

18. Complete the problems under the ***Review*** section. Show the equation you used to calculate the number of base pairs in the 10-repeat unit below.

19. Sometimes PCR fails and instead of having two bands you end up with just one. The elephants represented in lanes 3 and 5 could have been a match to the ivory sample if you failed to amplify one allele in either the ivory or the sample, so you cannot exclude these choices without running the experiment multiple times. On the other hand, you can definitely eliminate the elephants in lanes 1, 2, 4, and 6. Explain why.

20. ***Watch the video on the "Case Solved" slide.*** Name two properties of a good marker and explain why good markers are important.

FREQUENCY PRIMER

21. How do you determine an allele's relative frequency?

22. The gel shows a DNA profile of the elephant you identified in Case One. What is the relative allele frequency of the smallest marker fragment? _____ Explain what this value means.

23. The truck containing the ivory was equally distant from three different parks, so scientists calculated allele frequencies using the genetic profiles of elephant populations from just those parks. If they had no idea of the source of the ivory, they would have needed to calculate frequencies using genetic profiles from elephant populations throughout Africa. Why would a scientist choose one of these methods over the other?

24. Looking at the calculation for profile probability, what does p^2 represent?

25. What does $2pq$ represent? Why is it important to "double" (multiply by 2) this frequency?

26. From the example, the homozygous frequency of the FH71 marker is 0.008 and the heterozygous frequency of the FH67 marker is 0.048.
    a. What is the heterozygous frequency of the FH127 marker? (Show your work.)

    b. What is the homozygous frequency of the FH19 marker? (Show your work.)

    c. Calculate the probability of an elephant having this exact DNA profile using all four markers. (Show your work.)

CASE TWO

27. ***Watch the crime scene video and read the Case Two introduction on the first slide.*** In Case One, you were looking for a match with an individual elephant. How does Case Two differ from Case One?

28. ***Watch the short video in the "Building a Reference Map" section.*** Elephant populations differ from one another. These differences are due to geographic distance and the length of time since their ancestors separated from one another. Explain how this relationship affects their relatedness.

29. Study the gel in the ***Building a Reference Map*** section. How does this gel differ from the gels you studied in Case One?

30. In the gel under the ***Applications*** section, why does the ivory sample contain only two bands while the other lanes (samples A and B) have multiple bands?

31. If an ivory sample has two alleles that are also found in a population sample, does that tell you with certainty that the ivory sample came from that population? Explain your answer.

32. Answer the questions in the ***Review*** section. If the scientist had collected 20 dung samples, would you expect more bands, fewer bands, or the same number of bands on the gel? Explain your answer.

33. Proceed to the ***Finding a Location*** section. Forest elephants and savanna elephants diverged over 2.5 million years ago, so some researchers think they should be classified as different species. Knowing this information, which genetic profiles would you predict would be more similar to one another: those of a forest elephant and a savanna elephant that are geographically close to one another, or those of two forest elephants that live far apart from one another? Explain your reasoning.

34. The three populations of savanna elephants that were chosen for further analysis are geographically distant from one another. Why does this approach make more sense than choosing three populations that are geographically close to one another?

35. On the ***Eliminating North, East, or South*** page, which population did you eliminate? _____ Which marker(s) allowed you to make this choice?

36. On the next page, which population did you eliminate? _____ Which marker(s) helped you make this choice?

37. By analyzing many more markers and all the populations, Dr. Wasser linked these seized ivory tusks to which country? _____

IVORY TRADE

38. **Watch the video on the "Stopping Illegal Poaching" slide.** Name two reasons elephant populations are threatened.

39. Most of the ivory is bought by Asian countries, but the United States is the second largest market. Name two actions that you could take to reduce elephant poaching.

40. In summary, elephants are a keystone species. Based on your knowledge of this term, explain in your own words why it is important to the ecology and ecosystems of Africa to save the elephant populations.