

DNA Forensics/Human Genetic Diversity **1.5 pts**

F 09

due at noon on Friday 12/4/09

Objectives:

1. Learn how the PCR method of genetic analysis is used to identify human forensic samples.
2. Examine some of the statistical data associated with the markers currently used for analysis of forensic samples by law enforcement in the U.S.

Procedure:

- A. Go to a computer with internet access.
- B. Go to the site for the url: <http://www.dnai.org/> which is the DNA Interactive site.
- C. Click on Applications on the upper right of the page.
- D. Click on **Human Identification** on the lower left of the page.
- E. Click on innocence on the upper right of the page, then on the red arrow.

Start answering the questions below:

1. Who was convicted of four crimes (including rape, in circumstances that would have left a DNA sample), and in what state and year?

2. What organization took on this man's case for further examination, and in what year?

3. What did the police and court indicate had happened to the relevant evidence (rape kit)?

4. Who found some relevant evidence, where, and in what year?

5. When four short tandem repeats (STRs) in the DNA of Mr. Anderson were compared with the same STRs from the samples from the crime scene, was there a match? [Click on Try the comparison.] (Note: To positively link two samples by DNA analysis, all of the markers must match.) Answer yes or no, and then explain your answer by indicating which markers do or do not match.

F. Next click on Today's DNA profile to see how DNA analysis is currently performed on forensic samples.

6. How many different markers does the FBI currently analyze when doing their DNA forensic work? _____

7. On how many different chromosomes are these markers found? _____

8. Is one pair of markers found on the same chromosome, and if so, which chromosome and which pair of markers

_____ & _____

9. The answers to questions 7 and 8 tell you something important about the most productive approach to analyzing DNA samples to determine if they came from different humans. (Think meiosis here.) In 5 sentences or less, what do they tell you. (Use back of page if needed.)

G. Next click right arrow indicator (▶) in white box to learn more about the analysis.

10. Do STRs tend to be polymorphic (have many different genetic options in different humans) or do they tend to have the same (one) form in all people? Note: This means you are examining only one locus (specific location on a specific chromosome). A population that is polymorphic would contain individuals with many different possible DNA arrangements at that specific locus.

11. The term allele describes a possible DNA arrangement at a given locus. If a person has two different alleles (remember, most human cells are diploid), are they said to be homozygous or heterozygous?

12. What does PCR stand for, and what does the PCR technique do?

13. How are the products of the PCR reactions described at the DNAi website detected?

14. Which markers are identified using green labels?

15. The different labeled pieces of DNA produced by the PCR reaction are separated on a polyacrylamide gel. Which pieces move faster on this system, the big pieces or the small pieces?

16. Looking at the blue markers example, indicate whether the person shown was heterozygous or homozygous for the following markers?

D21S11 _____

CSF1PO _____

17. What was the name of Reginald Punnett's friend? _____

18. Write the Hardy-Weinberg equation:

19. a) Which allele has the highest frequency for the D8S1179 marker in the Asian subgroup of the population, and b) what is its frequency? c) How many eggs or sperm out 1000 Asian reproductive cells will have that marker? [Haploid situation]. d) How many Asian ancestry people out of 1000 will be homozygous for D8S1179? (Diploid situation; assume the Hardy-Weinberg equation applies.) e) How many Asian ancestry people out of 1,000,000 will be homozygous for that allele?

a) _____ b) _____

c) _____ (Show calc. at right.)

d) _____ (Show calc. at right.)

e) _____ (Show calc. at right.)

20. a) Which allele has the lowest frequency for the D8S1179 marker in the _____ subgroup of the population (you fill in the blank with a group *other than* Asian), and b) what is its frequency? c) How many eggs or sperm out 1000 [same group as in a)] reproductive cells will have that marker? [Haploid situation]. d) How many [same group] ancestry people out of 1000 will be homozygous for D8S1179? (Diploid situation; assume Hardy-Weinberg applies.) e) How many [same group] ancestry people out of 1,000,000 will be homozygous for that allele?

a) _____ b) _____

c) _____ (Show calc. at right.)

d) _____ (Show calc. at right.)

e) _____ (Show calc. at right.)

21. *Closing comment on classifying a person to a specific ancestry:* Illustrated by Tiger Woods (acknowledged by many as the world's best golfer, by a considerable margin.): You are welcome to Google or Wikipedia this. **Do cite your source.**

a) What is Tiger Woods' ancestry? Give names & %'s. source:

b) What term has Mr. Woods used to describe his ethnicity? _____

c) Would you expect Mr. Woods in general terms to be more homozygous or heterozygous than the average person in the U.S. population? Briefly explain your answer.

d) Define the terms "hybrid vigor" (*i.e.*, heterosis) and "inbreeding depression" **Cite your source.** Would the term "hybrid vigor" (*i.e.*, heterosis) or the term "inbreeding depression" be a more accurate description of Mr. Woods' ancestry? (Only consider ancestry issues, not projected performance issues).

source: _____

hybrid vigor: _____

inbreeding depression: _____

Mr. Wood's ancestry is more accurately described by the term: _____