



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE BIOTECHNOLOGY

SBC 422: FORENSIC DNA TECHNIQUES

DATE: Wednesday 28th March, 2012

TIME: 11.00 a.m. – 1.00 p.m.

SECTION A: ANSWER ALL QUESTIONS (20 MARKS)

1. Which one among the following DNA sequences has little value in forensic science?

- A) Exons
- B) Introns
- C) Variable number tandem repeats
- D) Short tandem repeats
- E) Y chromosome

2. High _____ variation at a specific locus provides the basis for DNA typing

- A) DNA sequence
- B) Mutation
- C) Allelic
- D) DNA length
- E) Trait

3. The DNA sequences of the allele shown is an example of

(Sample 1) ACCT(C AT G TA C)₂-(G TA C AT G)₂GAT

(Sample 2) ACCT(C AT G TA C)₄-(G TA C AT G)₃GAT

- A) Sequence polymorphism
 - B) Length polymorphism
 - C) Allele polymorphism
 - D) Macrosatellites DNA
 - E) Variable number tandem repeats
4. Which one among the following markers is not applicable in nuclear DNA forensics?
- A) Allele specific oligonucleotide
 - B) Short tandem repeat
 - C) Restriction fragment length polymorphism
 - D) Random amplified fragment length polymorphism
 - E) Amplified fragment length polymorphism
5. How is the power of discrimination increased in PCR and RFLP forensic techniques?
- A) By using a large number of alleles in both cases
 - B) By using fewer alleles in both cases
 - C) By using fewer alleles for PCR and many alleles for RFLP
 - D) By involving more loci for PCR and 4 to 5 loci for RFLP
 - E) By using more loci in both cases
6. Which group of markers is applicable for Y chromosome, nuclear DNA and mitochondrial DNA typing?
- A) SNPs, STRs and VNTRs
 - B) SNPs, PCR, VNTRs
 - C) SNPs, STRs, RFLP
 - D) SNPs, PCR, RFLP
 - E) VNTRs, RFLP, AMFLP

7. When performing low copy number DNA typing, the following strategy will not increase the likelihood of generating a DNA profile

- A) Reducing the number of PCR cycles (34 to 28)
- B) Reducing PCR volume
- C) Using nested PCR
- D) Using better signal to noise ratio fluorescent tags
- E) Including a post-PCR cleanup step

8. Which group of the following forensic samples contains sources of DNA fit for LCN DNA profiling?

- A) Single cells, blood, cigarettes, finger nails, latex gloves
- B) Single cells, cigarettes, finger nails, epithelial cells, single hairs
- C) Single hairs, saliva, touched paper, finger prints, strangulation tools
- D) Blood, saliva, bones, teeth, semen, finger prints, finger nails
- E) Bones, teeth, finger prints, finger nails, strangulation tools, latex gloves

Use this sequence to answer questions 9, 10, 11, 12, 13 and 14

5'---- CGCCTCGGCCTCCCAAGAGTGTCTGAGATTACAGGCGTGAACCACCATGCCTAGCCGTTAGCTCCCA
CTTATGAGTGAGAAACAGGTGATGTTTTGGTTTTCCATTCTGAGTTACTTTACCCAGAATTGTTGT
CTCCAATCTCATCGAGGTCTCTGCGAATGCCAGTAATTCATT
ATATATACATATACATATATATGTATACACACATATACATATATATGTATACACACAT
ATACATATATATGTATACACACATATACATATATATGTATACACACATATACATATATATGTATA
CACACATATACATATATATGTATACACACATATACATATATATGTATACACACATATACATATAT
ATGTATACACACATATACATATATATGTATACACACATATACATATATATGTATACACACATATA
CATATATATGTATACACACATATACATATATATGTATACACACATATACATATATATGTATACAC
ACATATACATATATATGTATACACACATATACATATATATGTATACACACATATACATATATATG
TATACACACATATACATATATATGTATACACACATATACATATATAGTATACACACATATACATA
TATATGTATACACACATATACATATATATGTATACACACATATACATATATATGTATACACACAT
ATACATATATATGTATACACACATATACATATATATGTATACACACATATACATATATATACATATA
TACACAAACACACATGCACCGCACTTTTTTTTTTTTTTTTTTTTGAATGGGAGTCTCACTCTAT
CACCAGGCTGGAGTGCAGTGGTGTGATCTTGGCTCACTGCAACCTCTGTCTCCTGGGTTCAAGCT
ATTCTCCTGCTTCAGCCTCCTGAGTAGCTGGGATTACAGGTGCTCACCACCATGCCCAGCTAATT
TTTGTATTTTTTACCATGTTGGCCAGGATGATCTCCATCTCCTGACCTCCTGATCCTCCTGCCTTG
GGGTCCCAAAAGTGCAGGGATTGCAGGCATGAGCCACTGCATGTGGCCACACCACACTTCCTTTAT
CCACTTGTGGATGGATGGGCATTTGTGTTGAAAAG



9. The sequence of the repeating unit is _____. (1 Mark)
10. Sequence is repeating itself _____ times in the segment (1 Mark)
11. By use of the primer pairs indicated at the bottom of the DNA segment, is it possible to use PCR to directly obtain a DNA profile of the allele? _____. (1 Mark)
12. Assuming the repeat unit does not have restriction enzyme sites, is it possible to use the PCR products in an RFLP procedure to detect a discriminatory DNA profile? _____. (1 Mark)
13. This kind of polymorphism occur both in nuclear DNA and mitochondria DNA _____. (1 Mark)
14. If the locus were for LCN DNA profiling, more alleles could be observed using _____ . _____ primers. (2 Marks)
15. Every descendant of a particular woman has the same _____ sequence except for mutations
16. Because of lack of _____ the entire mtDNA is treated as a haplotype in forensics.
17. Mitochondrial DNA accumulate mutations and segregate during the lifetime of an individual resulting in a mixture mtDNA, a phenomenon called _____.
18. Using the X chromosome, half sisters must have _____ alleles between them to be half siblings.
19. If the alleles are _____ then the sisters are not half siblings.

SECTION B: ANSWER ALL QUESTIONS (5 MARKS EACH)

1. DNA taken from blood cells, skin cells, semen cells, or any other kind of cell is identical in an organism. How is this important in forensic science (5 Marks)
2. Using forensic DNA technology, *individualization* cannot be proven; but can only be convinced. Discuss briefly. (5 Marks)
3. Describe how PCR can be used to increase the power of discrimination compared to RFLP (5 Marks)
4. Give the definitions of the following terms as used in forensic science (5 Marks)
- a) Allele
 - b) Genetic marker
 - c) Individualization
 - d) Power of discrimination
 - e) Allelic drop-out
5. Approximately 97% of human genome is said to be 'junk', yet only 1% of the total genome is relevant for forensic analysis. Explain why (5 Marks)

6. From the allele marker frequencies given in the table below, calculate the best probabilities of discriminating two individuals from each group sharing two similar alleles CSF1PO and D2S1338 (5 marks).

Allele	African-American (n = 357)	U.S. Caucasian (n = 349)	U.S. Hispanic (n = 290)	Native American (n = 191)
CSF1PO				
6	*	*	*	*
7	4.62	0.14*	0.34*	*
8	7.56	0.29*	0.17*	0.52*
9	3.78	1.72	0.86*	8.38
10	27.87	24.21	23.10	30.89
11	20.59	31.81	28.28	21.99
11.3	0.14*	*	*	*
12	29.13	32.81	39.66	32.72
13	5.32	7.31	6.38	4.71
14	0.98	1.43	0.86*	0.79*
15	*	0.29*	0.34*	*
D2S1338				
15	0.14*	*	*	*
16	5.32	4.73	2.41	2.62
17	10.78	17.34	21.21	9.95
18	5.60	6.30	4.14	7.07
19	14.15	13.75	22.76	29.58
20	6.02	14.61	13.79	9.69
21	14.01	2.58	2.59	2.36
22	13.17	4.01	7.41	15.18
23	10.78	11.46	11.38	11.78
24	9.80	11.75	8.45	7.85
25	8.12	10.60	5.17	3.14
26	1.96	2.72	0.69*	0.79*
27	0.14*	0.14*	*	*
28	*	*	*	*

SECTION C: ANSWER ANY TWO QUESTIONS (10 MARKS EACH)

1. During a random forensic DNA profiling, 74% of the Y chromosome in a population of street children is Kikuyu, 15% Kamba, 6% Luo and 5% Luhya. On the other hand, the mtDNA profiling turned out 95% Kikuyu and 4.5% Kamba. Discuss these results forensically.
2. The DNA profile of a suspect matches that of the victim and evidence. What is your diagnosis of the situation and what could be the remedy(ies) that could either convict or exonerate the suspect?
3. Describe the categories of SNPs used in forensic DNA technology